Auxiliary File and Scripting Tips

PowerWorld Corporation

2001 South First Street
Champaign, Illinois 61820
+1 (217) 384.6330

support@powerworld.com
http://www.powerworld.com

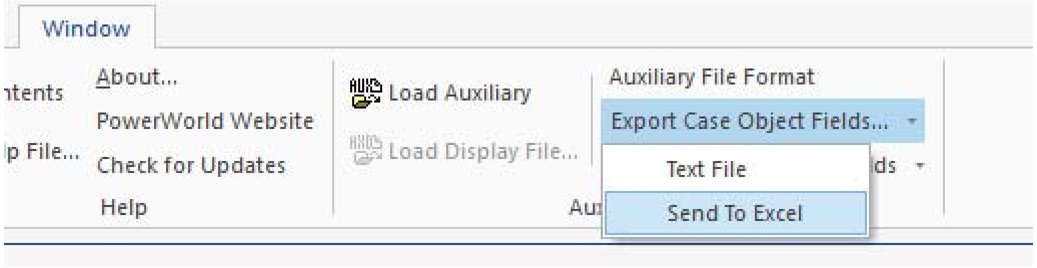
Available Online Help

- https://www.powerworld.com/WebHelp/Content/Other_Documents/Auxiliary-File-Format.pdf
  - Most up-to-date description of all available script commands and other auxiliary file related information
- https://www.powerworld.com/WebHelp/
  - Most up-to-date help information for all of Simulator
  - This contains the SimAuto documentation

© 2018 PowerWorld Corporation

Export Case Object Fields (More Documentation)

- The only comprehensive documentation about all of the object types and fields that are available



Export Case Object Fields

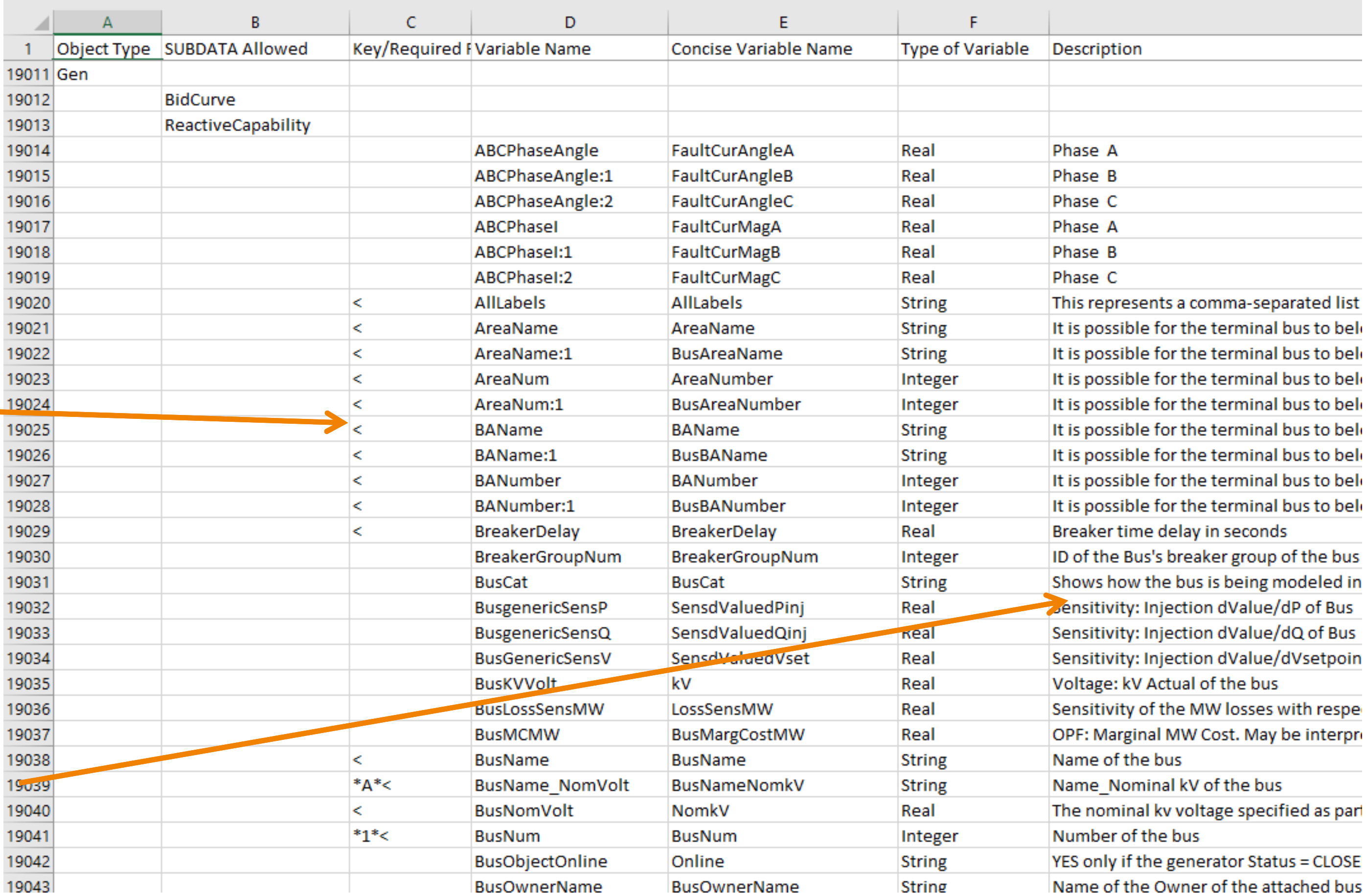
< Included in Difference Case comparison

***** Required for creating object

1, 2, 3 Primary key

A, B, C Secondary key

For the majority of fields the description found here is the most comprehensive information that you will find describing them



	A	B	C	D	E	F	
1	Object Type	SUBDATA Allowed	Key/Required F	Variable Name	Concise Variable Name	Type of Variable	Description
19011	Gen						
19012		BidCurve					
19013		ReactiveCapability					
19014				ABCPhaseAngle	FaultCurAngleA	Real	Phase A
19015				ABCPhaseAngle:1	FaultCurAngleB	Real	Phase B
19016				ABCPhaseAngle:2	FaultCurAngleC	Real	Phase C
19017				ABCPhaseI	FaultCurMagA	Real	Phase A
19018				ABCPhaseI:1	FaultCurMagB	Real	Phase B
19019				ABCPhaseI:2	FaultCurMagC	Real	Phase C
19020			<	AllLabels	AllLabels	String	This represents a comma-separated list
19021			<	AreaName	AreaName	String	It is possible for the terminal bus to bel
19022			<	AreaName:1	BusAreaName	String	It is possible for the terminal bus to bel
19023			<	AreaNum	AreaNumber	Integer	It is possible for the terminal bus to bel
19024			<	AreaNum:1	BusAreaNumber	Integer	It is possible for the terminal bus to bel
19025			<	BAName	BAName	String	It is possible for the terminal bus to bel
19026			<	BAName:1	BusBAName	String	It is possible for the terminal bus to bel
19027			<	BANumber	BANumber	Integer	It is possible for the terminal bus to bel
19028			<	BANumber:1	BusBANumber	Integer	It is possible for the terminal bus to bel
19029			<	BreakerDelay	BreakerDelay	Real	Breaker time delay in seconds
19030				BreakerGroupNum	BreakerGroupNum	Integer	ID of the Bus's breaker group of the bus
19031				BusCat	BusCat	String	Shows how the bus is being modeled in
19032				BusgenericSensP	SensdValuedPinj	Real	Sensitivity: Injection dValue/dP of Bus
19033				BusgenericSensQ	SensdValuedQinj	Real	Sensitivity: Injection dValue/dQ of Bus
19034				BusGenericSensV	SensdValuedVset	Real	Sensitivity: Injection dValue/dVsetpoin
19035				BusKVVolt	kV	Real	Voltage: kV Actual of the bus
19036				BusLossSensMW	LossSensMW	Real	Sensitivity of the MW losses with respe
19037				BusMCMW	BusMargCostMW	Real	OPF: Marginal MW Cost. May be interpr
19038			<	BusName	BusName	String	Name of the bus
19039			*A*<	BusName_NomVolt	BusNameNomkV	String	Name_Nominal kV of the bus
19040			<	BusNomVolt	NomkV	Real	The nominal kv voltage specified as par
19041			*1*<	BusNum	BusNum	Integer	Number of the bus
19042				BusObjectOnline	Online	String	YES only if the generator Status = CLOSE
19043				BusOwnerName	BusOwnerName	String	Name of the Owner of the attached bus

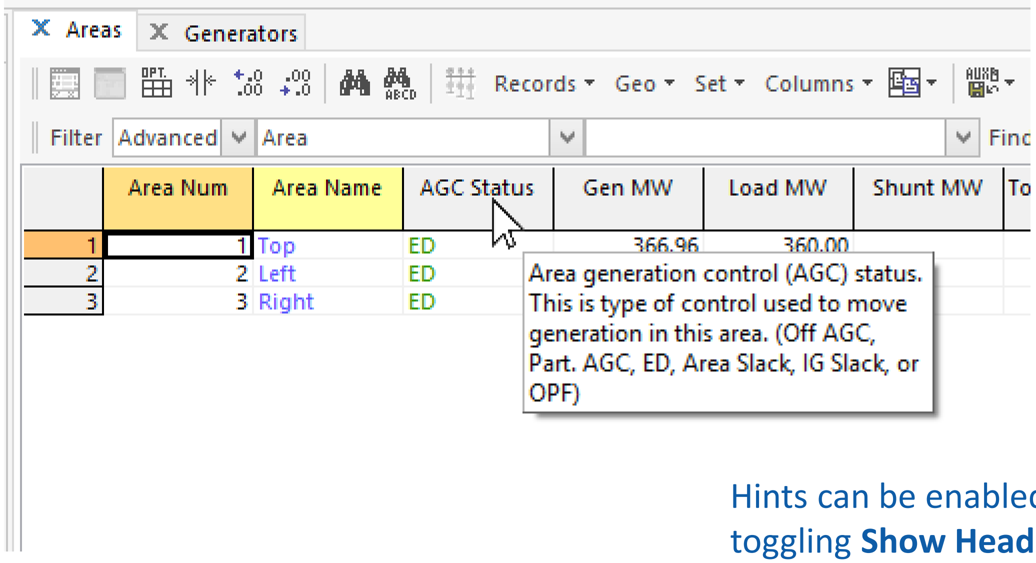
© 2018 PowerWorld Corporation

Export Case Object Fields

- SimAuto functions for obtaining field details
  - GetFieldList(ObjectType)
    - Return all fields and details for a particular object type
  - GetSpecificFieldList(ObjectType, FieldList)
    - Return specified fields and details for a particular object type

Hover Hints

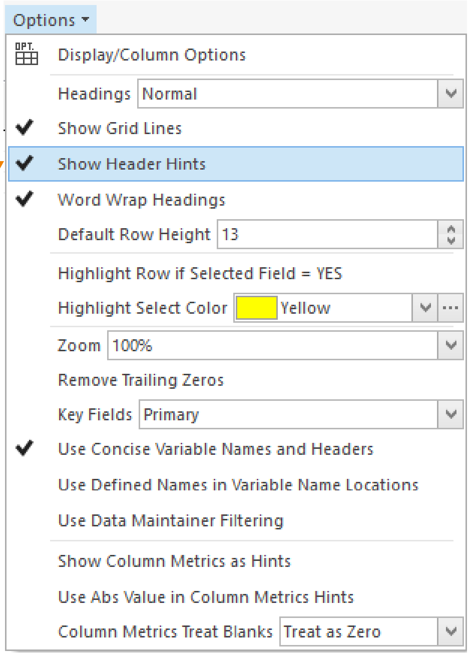
- Hover over column headers in case information displays to see the description of fields



	Area Num	Area Name	AGC Status	Gen MW	Load MW	Shunt MW	To
1	1	Top	ED	366.96	360.00		
2	2	Left	ED				
3	3	Right	ED				

Area generation control (AGC) status. This is type of control used to move generation in this area. (Off AGC, Part. AGC, ED, Area Slack, IG Slack, or OPF)

Hints can be enabled/disabled by toggling **Show Header Hints** option

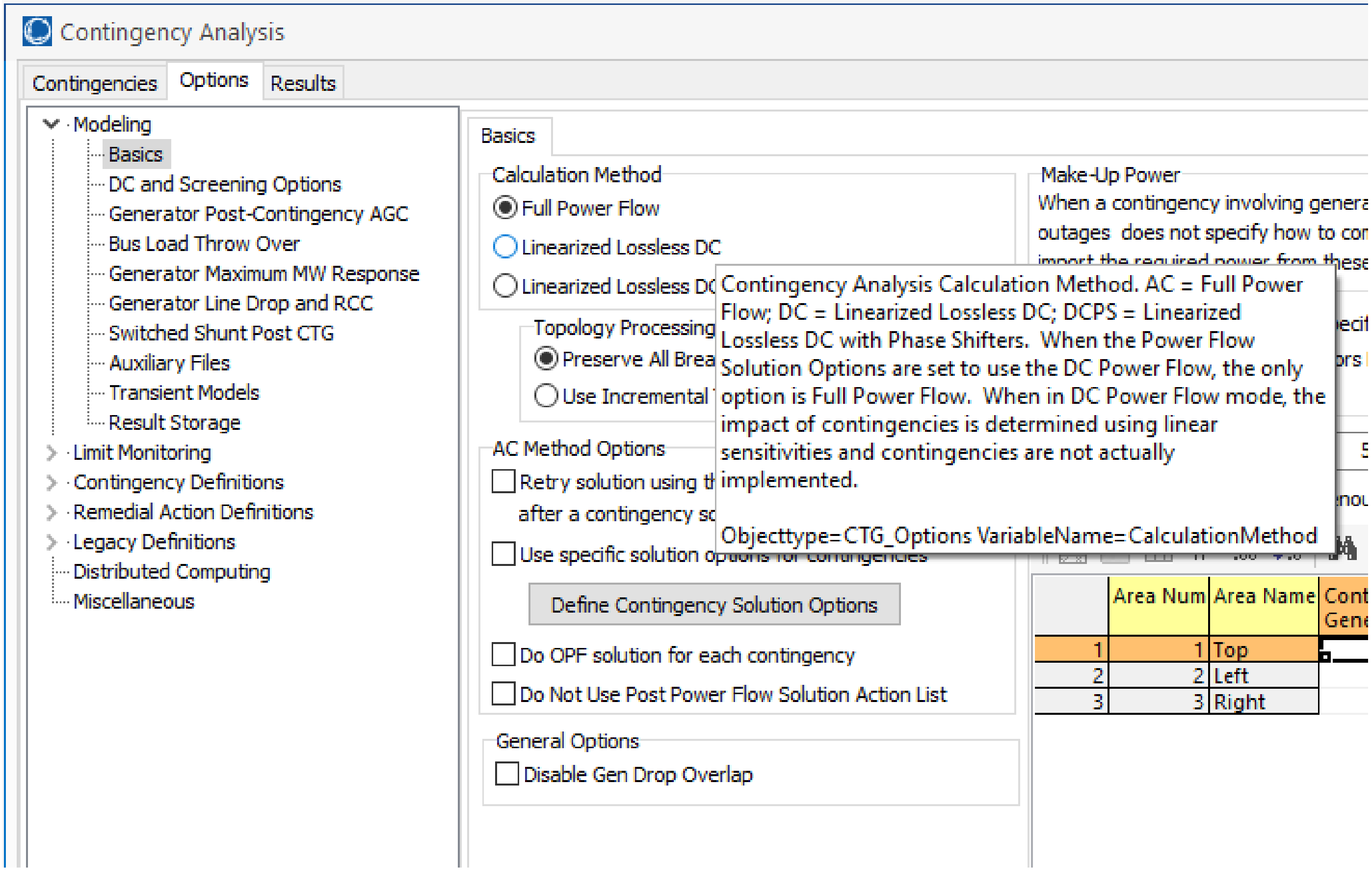


Headings: Normal
✓ Show Grid Lines
✓ Show Header Hints
✓ Word Wrap Headings
Default Row Height: 13
Highlight Row if Selected Field = YES
Highlight Select Color: 🟨 Yellow
Zoom: 100%
Remove Trailing Zeros
Key Fields: Primary
✓ Use Concise Variable Names and Headers
Use Defined Names in Variable Name Locations
Use Data Maintainer Filtering
Show Column Metrics as Hints
Use Abs Value in Column Metrics Hints
Column Metrics Treat Blanks: Treat as Zero

© 2018 PowerWorld Corporation

Hover Hints

- Some dialogs have hints that pop up when hovering over option fields
- These hints provide the object type and variable name for setting this option in an auxiliary file data section or script command



Calculation Method

● Full Power Flow

○ Linearized Lossless DC

○ Linearized Lossless DC

Topology Processing

● Preserve All Brea

○ Use Incremental

AC Method Options

□ Retry solution using th after a contingency so

□ Use specific solution options for contingencies

□ Do OPF solution for each contingency

□ Do Not Use Post Power Flow Solution Action List

General Options

□ Disable Gen Drop Overlap

Make-Up Power

When a contingency involving genera outages does not specify how to con import the required power from these

Contingency Analysis Calculation Method. AC = Full Power Flow; DC = Linearized Lossless DC; DCPS = Linearized Lossless DC with Phase Shifters. When the Power Flow Solution Options are set to use the DC Power Flow, the only option is Full Power Flow. When in DC Power Flow mode, the impact of contingencies is determined using linear sensitivities and contingencies are not actually implemented.

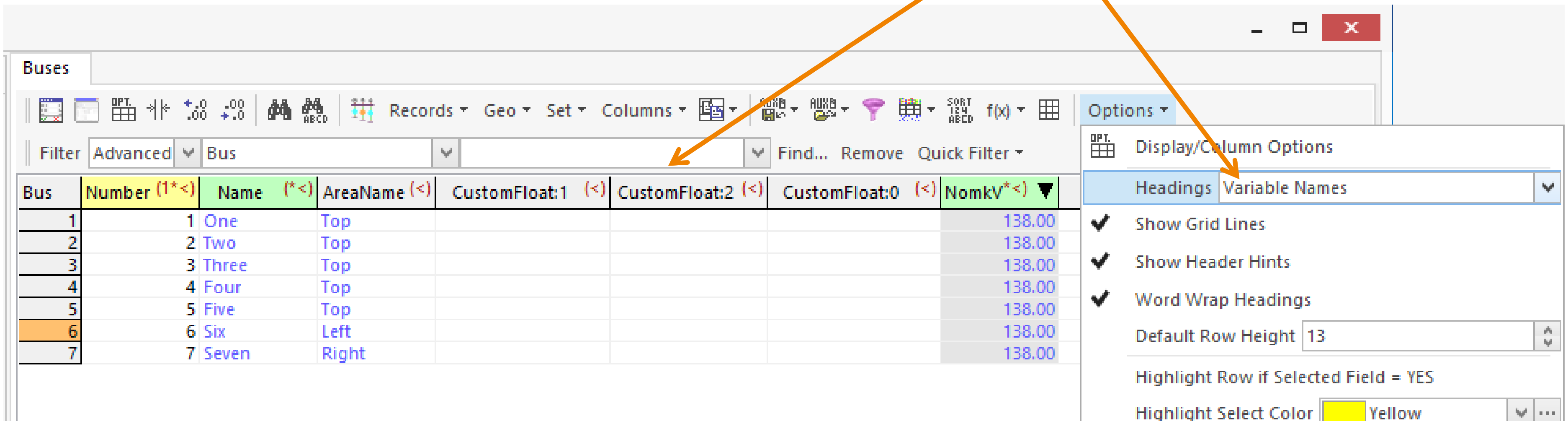
Objecttype=CTG_Options VariableName=CalculationMethod

	Area Num	Area Name	Cont Gene
1	1	Top	
2	2	Left	
3	3	Right	

© 2018 PowerWorld Corporation

Specifying Field Variable Names

- Variable Names are used within auxiliary file DATA and SCRIPT sections to identify fields
- For help in creating auxiliary files, column headers within the Model Explorer can be set to show the variable names instead



Bus	Number (1*<)	Name (*<)	AreaName (<)	CustomFloat:1 (<)	CustomFloat:2 (<)	CustomFloat:0 (<)	NomkV*<
1	1	One	Top				138.00
2	2	Two	Top				138.00
3	3	Three	Top				138.00
4	4	Four	Top				138.00
5	5	Five	Top				138.00
6	6	Six	Left				138.00
7	7	Seven	Right				138.00

Headings: Variable Names

✓ Show Grid Lines

✓ Show Header Hints

✓ Word Wrap Headings

Default Row Height: 13

Highlight Row if Selected Field = YES

Highlight Select Color: Yellow

© 2018 PowerWorld Corporation

Specifying Field Variable Names

- Variables follow the naming convention `variablename:location` where `location` is an integer indicating the exact variable to be used
- This convention is considered the legacy convention where the same `variablename` was re-used by tacking on the `location`
- Starting with Simulator version 19, *concise* variable names have been created in an attempt to get rid of the `location` in as many variables as possible and to make the names more obvious

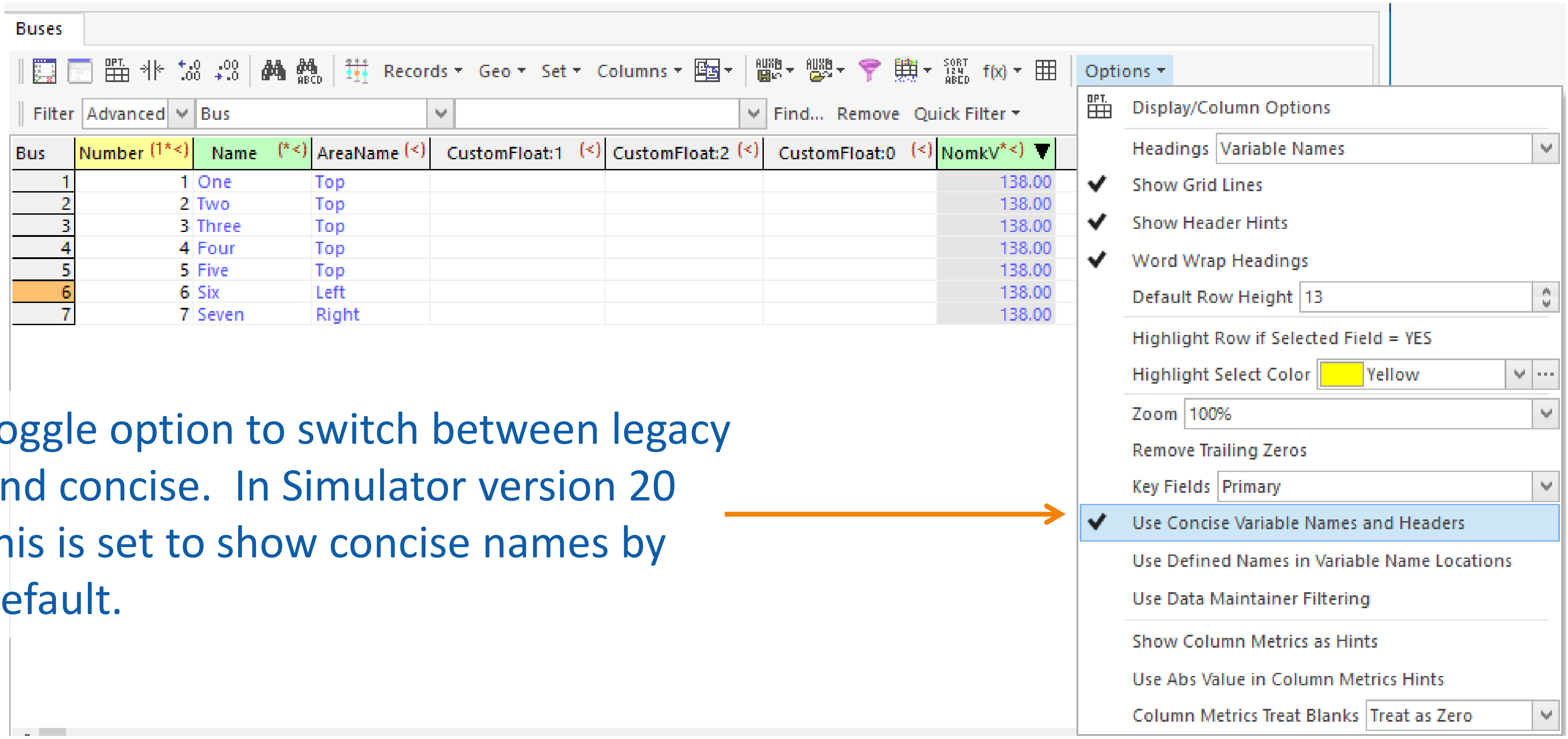
Specifying Field Variable Names Legacy vs. Concise

- The legacy variables to indicate the MW flow at the from end and to ends of a branch are:
  - `LineMW:0` (:0 is typically omitted because :0 is assumed if no location specified)
  - `LineMW:1`
- The same variables in the concise format are:
  - `MWFrom`
  - `MWTo`

© 2018 PowerWorld Corporation

Specifying Field Variable Names Legacy vs. Concise

- Both versions of a field variable name can be shown in the Model Explorer



Bus	Number (1*<)	Name (*<)	AreaName (<)	CustomFloat:1 (<)	CustomFloat:2 (<)	CustomFloat:0 (<)	NomkV*<)
1	1	One	Top				138.00
2	2	Two	Top				138.00
3	3	Three	Top				138.00
4	4	Four	Top				138.00
5	5	Five	Top				138.00
6	6	Six	Left				138.00
7	7	Seven	Right				138.00

Display/Column Options

Headings: Variable Names

✓ Show Grid Lines

✓ Show Header Hints

✓ Word Wrap Headings

Default Row Height: 13

Highlight Row if Selected Field = YES

Highlight Select Color: Yellow

Zoom: 100%

Remove Trailing Zeros

Key Fields: Primary

✓ Use Concise Variable Names and Headers

Use Defined Names in Variable Name Locations

Use Data Maintainer Filtering

Show Column Metrics as Hints

Use Abs Value in Column Metrics Hints

Column Metrics Treat Blanks: Treat as Zero

Toggle option to switch between legacy and concise. In Simulator version 20 this is set to show concise names by default.

© 2018 PowerWorld Corporation

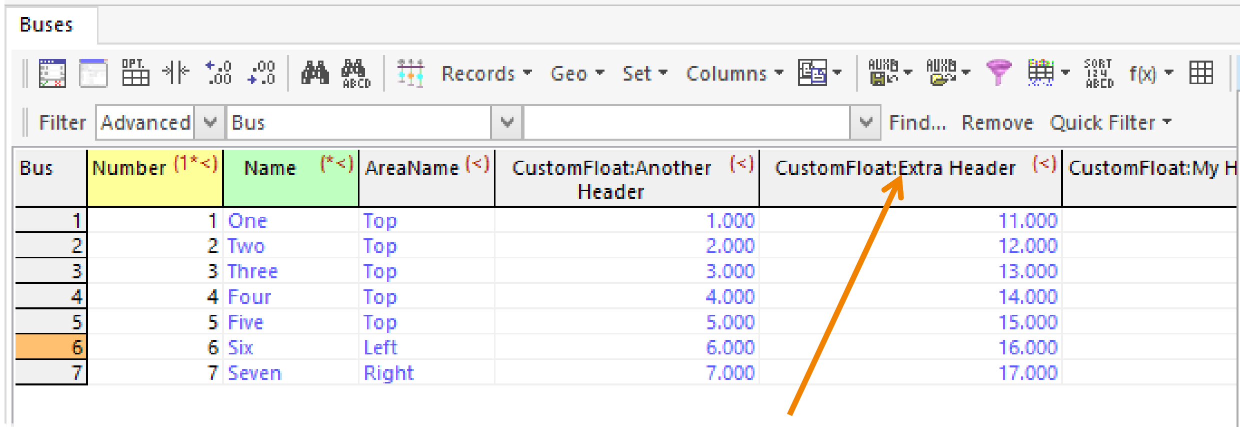
Specifying Field Variable Names

- `Location` indicators continue to exist for some variable names
- Typically these are fields for which a dynamic number exists
  - Fields that are available for most objects
    - `CustomExpression`, `CustomFloat`, `CustomInteger`, `CustomString`, `CustomExpressionStr`, `CalcFied`, `DataCheck`, and `DataCheckAggr`
  - Some example fields that are available for specific objects
    - Bus – `MargCostMWValue`, `MargControl`, `SensdValuedPinjMult`
    - Branch – `PTDFMult`, `LODFMult`, `LODFInterfaceMult`
    - Gen – `BidMW`, `BidMWHr`, `SensMultMeterMultControl`

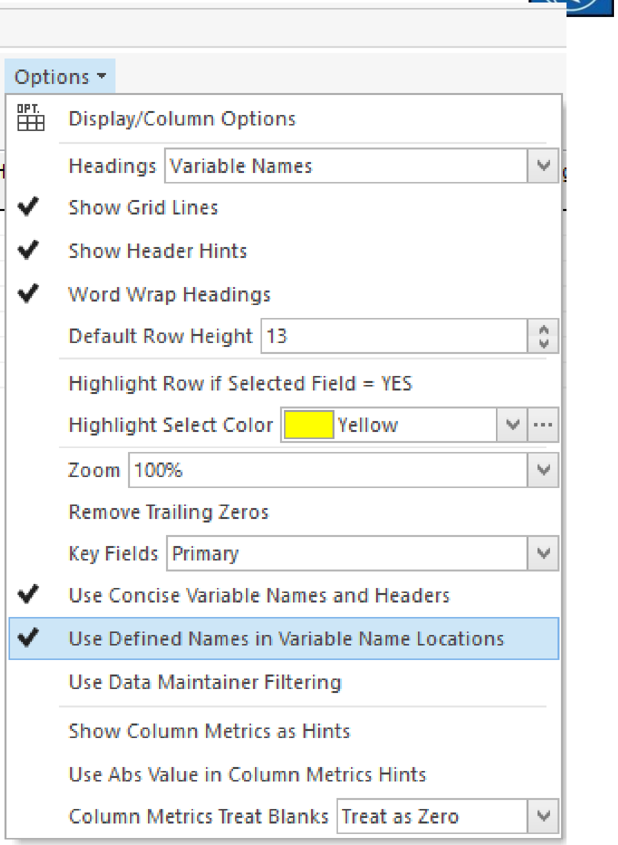
Specifying Field Variable Names

- To better identify dynamic fields, the `Location` can be replaced with `Location_by_name` for fields that have user-defined names
- This could help prevent conflicts in data where the same `Location` by number is being referenced in different auxiliary files but these should really be different fields
- The fields can be read and written by Simulator when used in auxiliary files
  - `CustomExpression`, `CustomFloat`, `CustomInteger`, `CustomString`, `CustomExpressionStr`, `CalcFied`, `DataCheck`, and `DataCheckAggr`
  - `"CustomFloat:`*`My Header`*`"`
  - `"CalcField:`*`My calculated field name`*`"`
  - `"DataCheckAggr:`*`Bus 'DataCheck Name'`*`"`

Specifying Field Variable Names

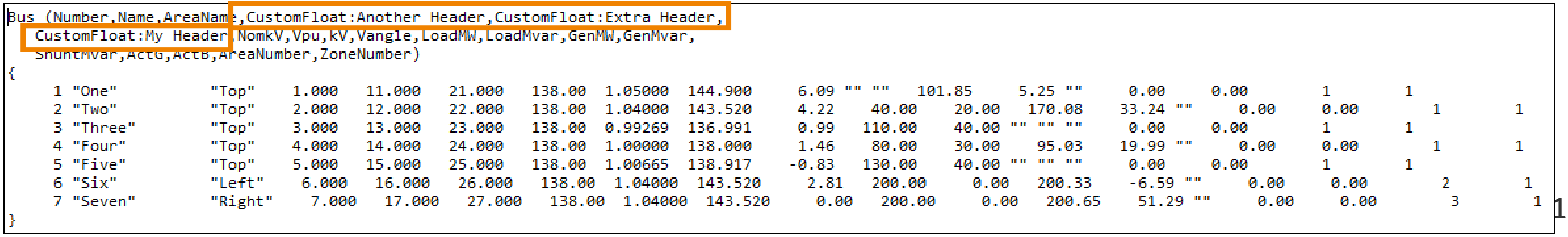


Bus	Number (1*<)	Name (*<)	AreaName (<)	CustomFloat:Another Header (<)	CustomFloat:Extra Header (<)	CustomFloat:My H
1	1	One	Top	1.000	11.000	
2	2	Two	Top	2.000	12.000	
3	3	Three	Top	3.000	13.000	
4	4	Four	Top	4.000	14.000	
5	5	Five	Top	5.000	15.000	
6	6	Six	Left	6.000	16.000	
7	7	Seven	Right	7.000	17.000	



Display/Column Options
Headings: Variable Names
✓ Show Grid Lines
✓ Show Header Hints
✓ Word Wrap Headings
Default Row Height: 13
Highlight Row if Selected Field = YES
Highlight Select Color: Yellow
Zoom: 100%
Remove Trailing Zeros
Key Fields: Primary
✓ Use Concise Variable Names and Headers
✓ Use Defined Names in Variable Name Locations
Use Data Maintainer Filtering
Show Column Metrics as Hints
Use Abs Value in Column Metrics Hints
Column Metrics Treat Blanks: Treat as Zero

Toggle **Use Defined Names in Variable Name Locations** to show the user-defined name within the case info grid and to use this when saving an auxiliary file



```
Bus (Number,Name,AreaName,CustomFloat:Another Header,CustomFloat:Extra Header,
   CustomFloat:My Header,NomkV,Vpu,kV,Vangle,LoadMW,LoadMvar,GenMW,GenMvar,
   ShuntMvar,ActG,ActB,AreaNumber,ZoneNumber)
{
     1 "One"          "Top"    1.000   11.000   21.000   138.00  1.05000  144.900     6.09 "" ""   101.85     5.25 ""     0.00     0.00        1        1
     2 "Two"          "Top"    2.000   12.000   22.000   138.00  1.04000  143.520     4.22    40.00    20.00   170.08    33.24 ""     0.00     0.00        1        1
     3 "Three"        "Top"    3.000   13.000   23.000   138.00  0.99269  136.991     0.99   110.00    40.00 "" "" ""     0.00     0.00        1        1
     4 "Four"         "Top"    4.000   14.000   24.000   138.00  1.00000  138.000     1.46    80.00    30.00    95.03    19.99 ""     0.00     0.00        1        1
     5 "Five"         "Top"    5.000   15.000   25.000   138.00  1.00665  138.917    -0.83   130.00    40.00 "" "" ""     0.00     0.00        1        1
     6 "Six"          "Left"    6.000   16.000   26.000   138.00  1.04000  143.520     2.81   200.00     0.00   200.33    -6.59 ""     0.00     0.00        2        1
     7 "Seven"        "Right"    7.000   17.000   27.000   138.00  1.04000  143.520     0.00   200.00     0.00   200.65    51.29 ""     0.00     0.00        3        1
}
```

Specifying Field Variable Names
Saving All Fields for a Variable

- What if you don't know how many fields exist for a particular variable name?
  - Multiple PTDF or LODF calculation produces a matrix of results based on the inputs selected
- Replace the `Location` identifier with the keyword `ALL`
  - `PTDFMult:ALL` or `LODFMult:ALL`
- Available with script commands that allow specifying fields to save to file
  - `CTGSaveViolationMatrices`, `SaveData`, `SaveDataWithExtra`, `SaveObjectFields`, and `SendToExcel`

© 2018 PowerWorld Corporation

Specifying Field Variable Names Saving All Fields for a Variable

- Available with SimAuto functions that get fields
  - GetParametersMultipleElement, GetParametersMultipleElementFlatOutput, GetParametersSingleElement, GetSpecifiedFieldList, SendToExcel, and WriteAuxFile
- Save the LODF matrix results to a CSV file

```
SaveData("myfile.CSV",CSVColHeader,Branch,[BusNumFrom,BusNumTo,
Circuit,LODFMult:ALL],[],,[],NO);
```

Hint: use filetype = CSVColHeader to identify the monitored branches by the normal names instead of variable names

Specifying Field Variable Names Saving All Fields for an Object Type

- What if you just want everything?
- Replace entire list of fields with keyword ALL
- Available with script commands that allow specifying fields to save to file
  - `CTGSaveViolationMatrices`, `SaveData`, `SaveDataWithExtra`, `SaveObjectFields`, and `SendToExcel`
- Available with SimAuto functions that get fields
  - `GetParametersMultipleElement`, `GetParametersMultipleElementFlatOutput`, `GetParametersSingleElement`, `GetSpecifiedFieldList`, `SendToExcel`, and `WriteAuxFile`

© 2018 PowerWorld Corporation

Specifying Field Variable Names Saving All Fields for an Object Type

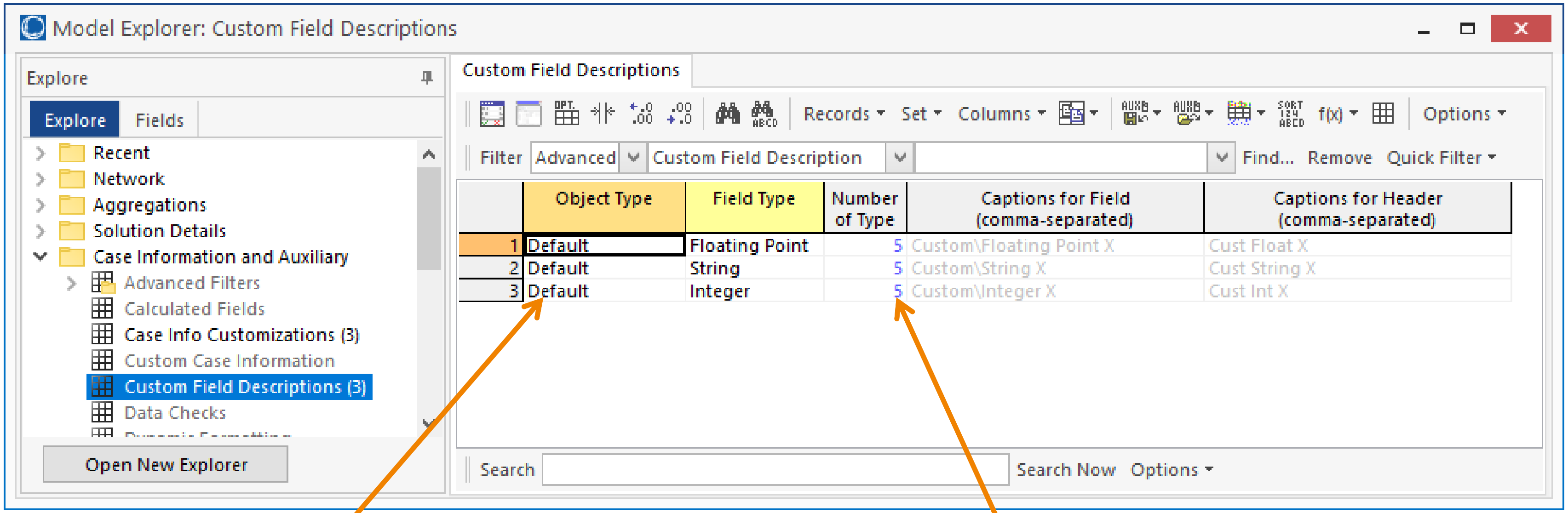
- Available with SimAuto functions that get fields
  - GetParametersMultipleElement, GetParametersMultipleElementFlatOutput, GetParametersSingleElement, GetSpecifiedFieldList, SendToExcel, and WriteAuxFile
- Saving all fields for a Branch

```
SaveData("myfile.CSV",CSVColHeader,Branch,[ALL],[],,[],NO);
```

Custom Fields

- Simulator has many fields, but sometimes that is not enough
- Custom fields are available for data that does not fit anywhere else
- Custom fields can also be useful for temporary storage of values
  - e.g. store the pre-change flow to compare against post-change flow
- By default 5 Custom Floating Point, Custom Integer, and Custom String fields are available for most objects
- Number and names of each type of field can be customized on an object type basis

Custom Fields
Custom Field Descriptions



Model Explorer: Custom Field Descriptions

Filter: Advanced | Custom Field Description

	Object Type	Field Type	Number of Type	Captions for Field (comma-separated)	Captions for Header (comma-separated)
1	Default	Floating Point	5	Custom\Floating Point X	Cust Float X
2	Default	String	5	Custom\String X	Cust String X
3	Default	Integer	5	Custom\Integer X	Cust Int X

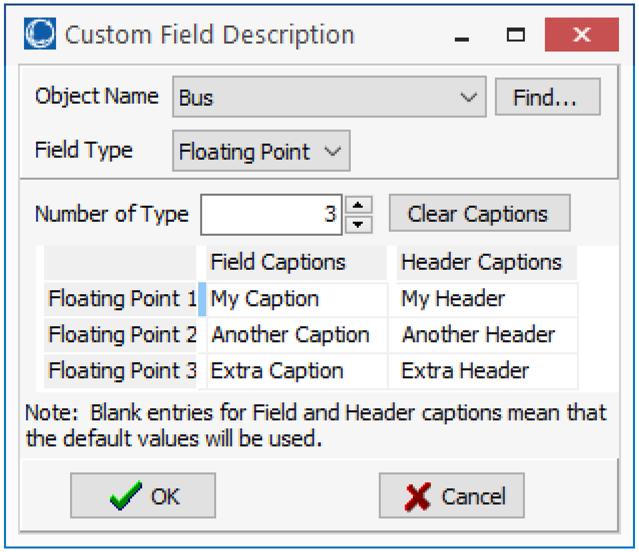
Default object types are always listed. These apply to all object types.

Number of default fields of a particular type can be changed without additional customization.

© 2018 PowerWorld Corporation

Custom Field Descriptions

- To customize for a particular object type right-click and choose **Insert** (or **Show Dialog** for existing)
  - Choose the **Object Name**
  - Choose the **Field Type**
  - Choose the **Number of Type**
  - Define Field Captions
  - Define Header Captions



Custom Field Description

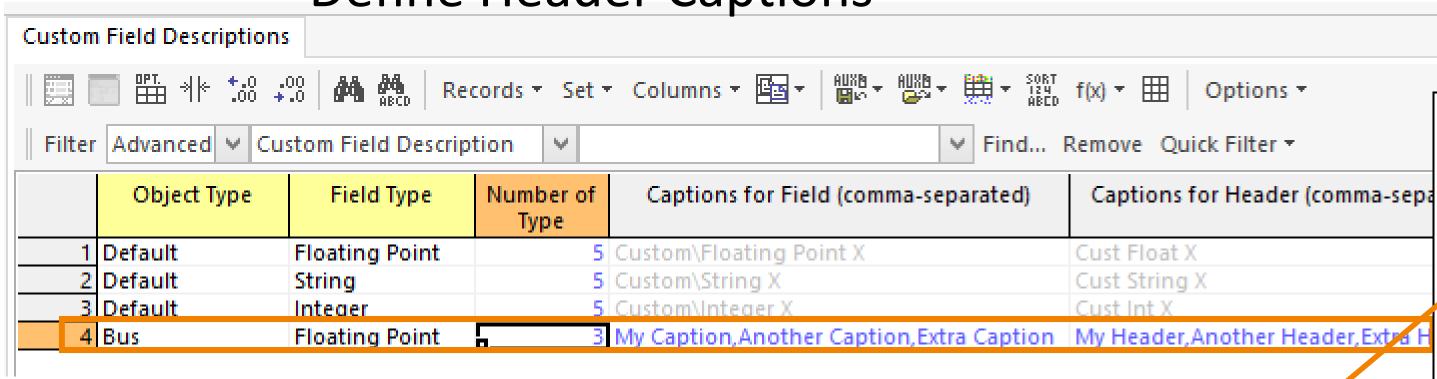
Object Name: Bus

Field Type: Floating Point

Number of Type: 3

	Field Captions	Header Captions
Floating Point 1	My Caption	My Header
Floating Point 2	Another Caption	Another Header
Floating Point 3	Extra Caption	Extra Header

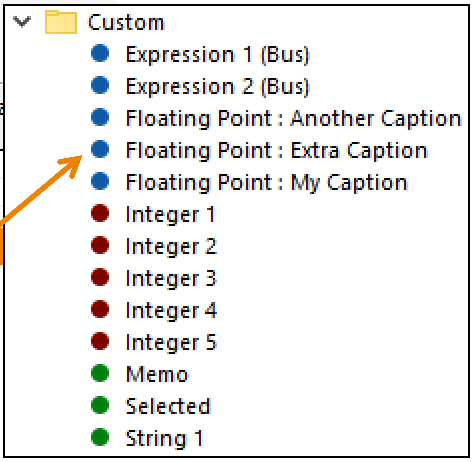
Note: Blank entries for Field and Header captions mean that the default values will be used.



Custom Field Descriptions

Filter: Advanced | Custom Field Description

	Object Type	Field Type	Number of Type	Captions for Field (comma-separated)	Captions for Header (comma-sepa
1	Default	Floating Point	5	Custom\Floating Point X	Cust Float X
2	Default	String	5	Custom\String X	Cust String X
3	Default	Integer	5	Custom\Integer X	Cust Int X
4	Bus	Floating Point	3	My Caption,Another Caption,Extra Caption	My Header,Another Header,Extra H



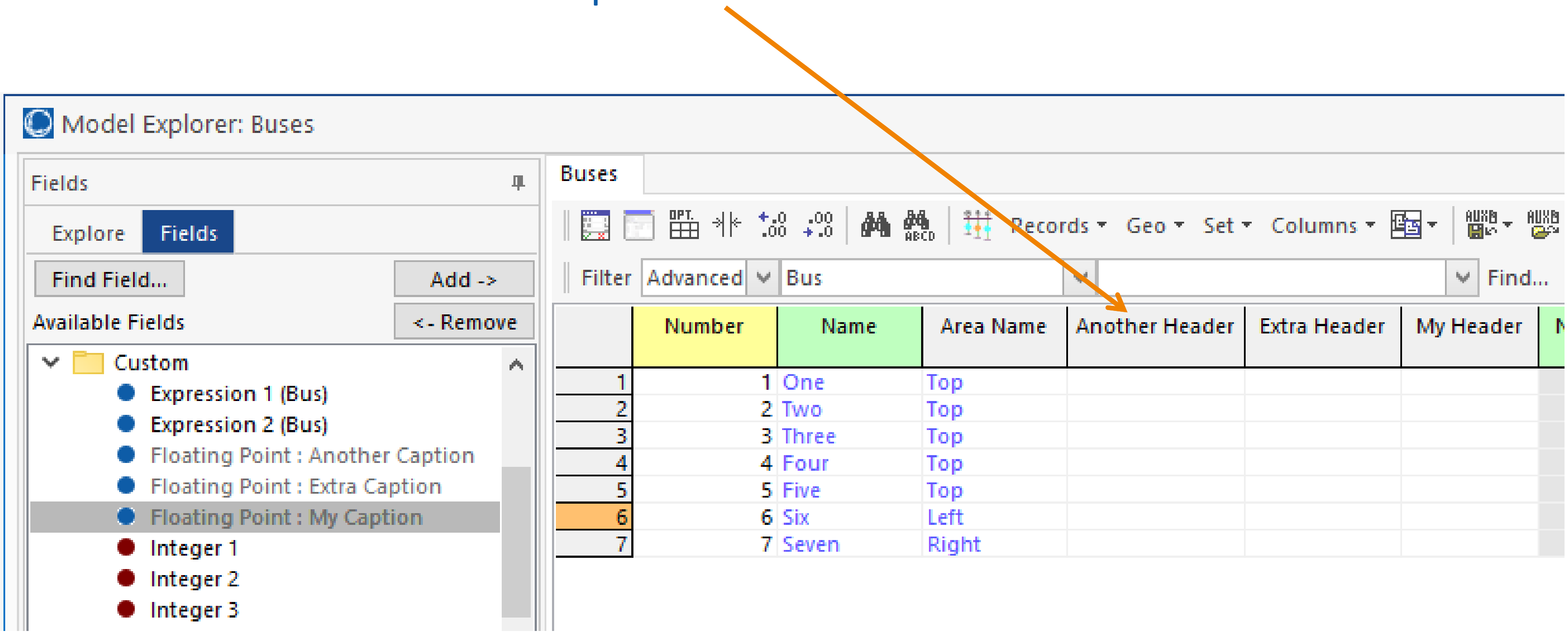
- Custom
  - Expression 1 (Bus)
  - Expression 2 (Bus)
  - Floating Point : Another Caption
  - Floating Point : Extra Caption
  - Floating Point : My Caption
  - Integer 1
  - Integer 2
  - Integer 3
  - Integer 4
  - Integer 5
  - Memo
  - Selected
  - String 1

List of available fields reflects the user-defined Field Captions

© 2018 PowerWorld Corporation

Custom Field Descriptions

Column headings reflect the user-defined Header Captions

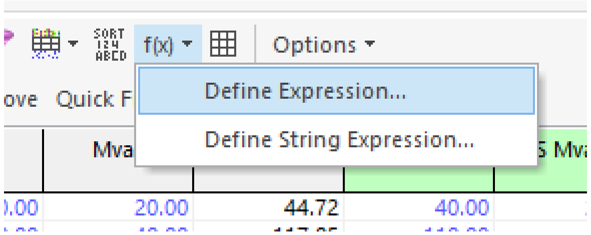


- Custom
  - Expression 1 (Bus)
  - Expression 2 (Bus)
  - Floating Point : Another Caption
  - Floating Point : Extra Caption
  - Floating Point : My Caption
  - Integer 1
  - Integer 2
  - Integer 3

	Number	Name	Area Name	Another Header	Extra Header	My Header
1	1	One	Top			
2	2	Two	Top			
3	3	Three	Top			
4	4	Four	Top			
5	5	Five	Top			
6	6	Six	Left			
7	7	Seven	Right			

Expressions

- Custom Expressions (Custom String Expressions)
  - Allow calculation to be performed on fields of the object type for which it is defined
  - Model Field, Model Expression, and Model String Expression fields can also be included in the expression function
- Model Expressions (Model String Expressions)
  - Allow calculation on specific fields of specific objects
- Provide a way of performing calculations and updating data within Simulator
- Useful with contingency actions and remedial actions for specifying the value of the applied action



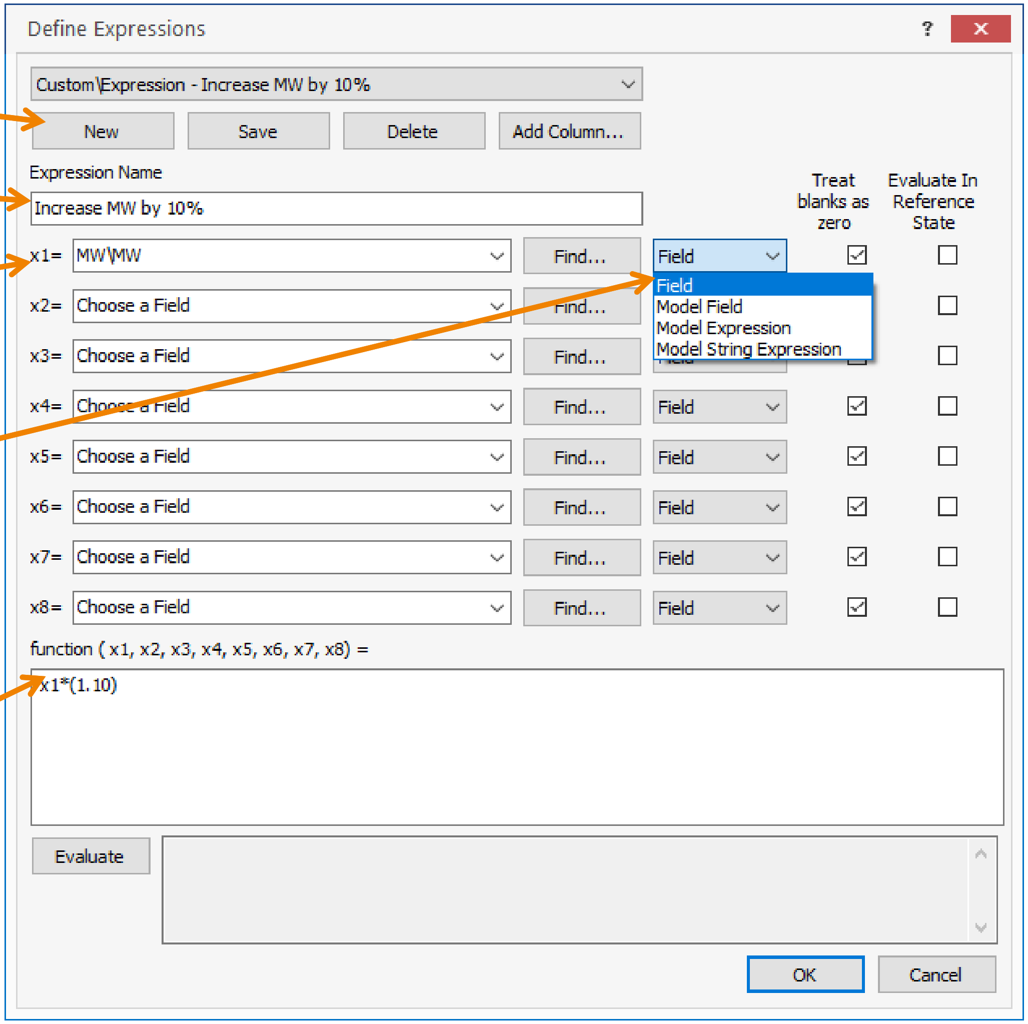
Expressions

Click **New** to add a new expression and then give it a meaningful name

Assign fields to expression variables

Fields can be a **Field** of the particular object type or access fields for particular model objects

Define the function for the expression



Custom\Expression - Increase MW by 10%

Expression Name: Increase MW by 10%

				Treat blanks as zero	Evaluate In Reference State
x1=	MW\MW	Find...	Field	☑	□
x2=	Choose a Field	Find...			□
x3=	Choose a Field	Find...			□
x4=	Choose a Field	Find...	Field	☑	□
x5=	Choose a Field	Find...	Field	☑	□
x6=	Choose a Field	Find...	Field	☑	□
x7=	Choose a Field	Find...	Field	☑	□
x8=	Choose a Field	Find...	Field	☑	□

function (x1, x2, x3, x4, x5, x6, x7, x8) =

```
x1*(1.10)
```

https://www.powerworld.com/WebHelp/#MainDocumentation_HTML/Functions_and_Operators_Available.htm

Expressions

- Example of increasing load by 10%
  - – Create expression *Increase MW by 10%*
  - – Update the load by the result of the expression using script command

```
SetData(Load, [MW], ["@CustomExpression"], ALL);

SetData(Load, [MW], ["@CustomExpression:Increase MW by
10%"], ALL);
```

Supplemental Data

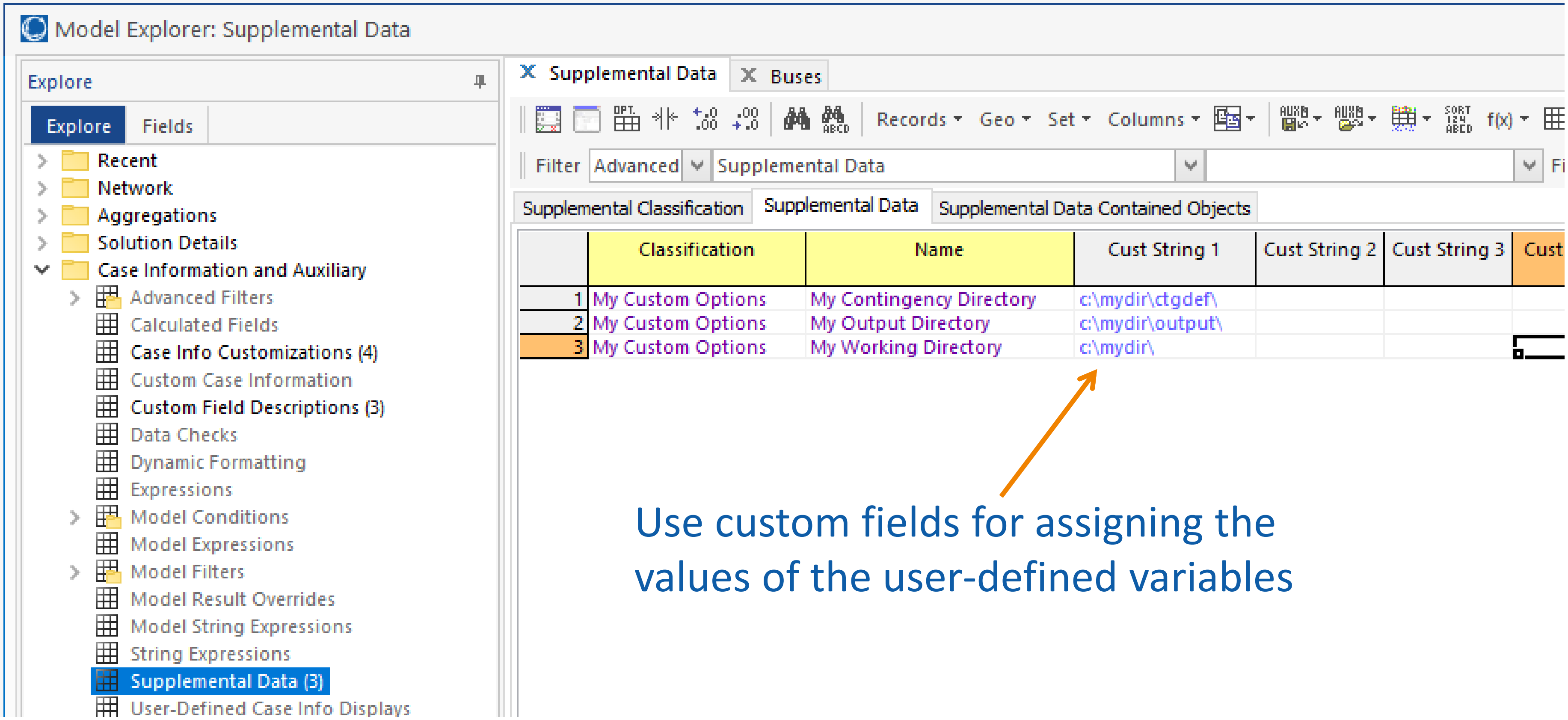
- Original intent was to allow extra information to be stored that is associated with display objects
- Can be used as a user-defined container object similar to other aggregation objects like areas, zones, substations, etc.
  - Details of this will be left for other discussions
- Within the context of script commands and auxiliary files can be used as a place to store user-defined variables
  - Reference these using the **Special Keywords in Script Commands** syntax, **Specifying Field Values in Script Commands** syntax, and as part of Custom Expressions and Model Expressions

© 2018 PowerWorld Corporation

Supplemental Data

- Two objects need to be defined
  - **Supplemental Classification**
    - This is used as the category to group the data
    - Example – *My Custom Options*
  - **Supplemental Data**
    - Individual pieces of information that belong to a Supplemental Classification
    - Assign to a Supplemental Classification and provide a Name
    - Example – **Classification** = *My Custom Options*, **Name** = *My Working Directory*

Supplemental Data



Filter Advanced Supplemental Data

	Classification	Name	Cust String 1	Cust String 2	Cust String 3	Cust
1	My Custom Options	My Contingency Directory	c:\mydir\ctgdef\			
2	My Custom Options	My Output Directory	c:\mydir\output\			
3	My Custom Options	My Working Directory	c:\mydir\			

Use custom fields for assigning the values of the user-defined variables

© 2018 PowerWorld Corporation

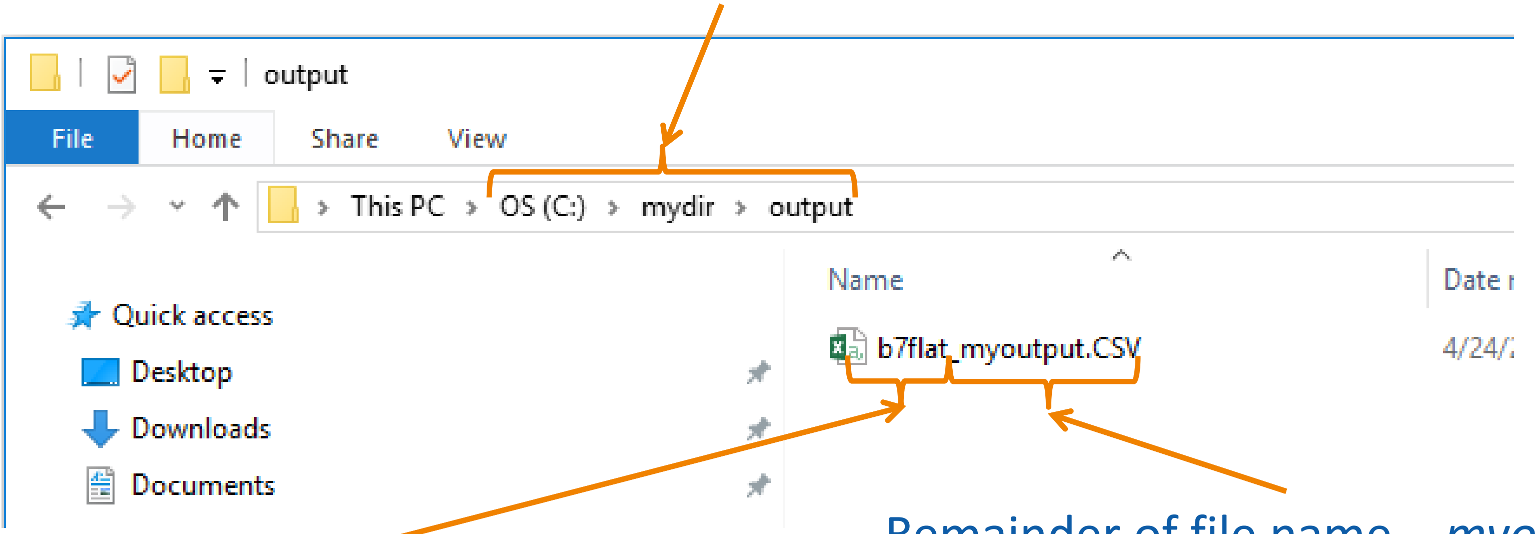
Special Keywords in Script Commands

- Allowed as part of file name parameters and other text parameters
  - Generally, these cannot be used for specifying the values to set for specific fields
- The following keywords will be replaced with their actual value when used by a script command
  - `@DATETIME`, `@DATE`, `@TIME`, `@BUILDDATE`, `@VERSION`, and `@CASENAME`
  - `@MODELFIELD<objecttype 'key1' 'key2' 'key3' variablename:digits:rod>`

Special Keywords in Script Commands

```
SaveData("@MODELFIELD<SupplementalData 'My Custom Options' 'My
Output Directory' CustomString>@CASENAME_myoutput.CSV", CSV,
Bus, [Number, NomkV, Vpu, Vangle], [],,[],NO);
```

Directory is specified by `@MODELFIELD<SupplementalData 'My Custom Options' 'My Output Directory' CustomString>`



@CASENAME includes *b7flat* from *b7flat.pwb*

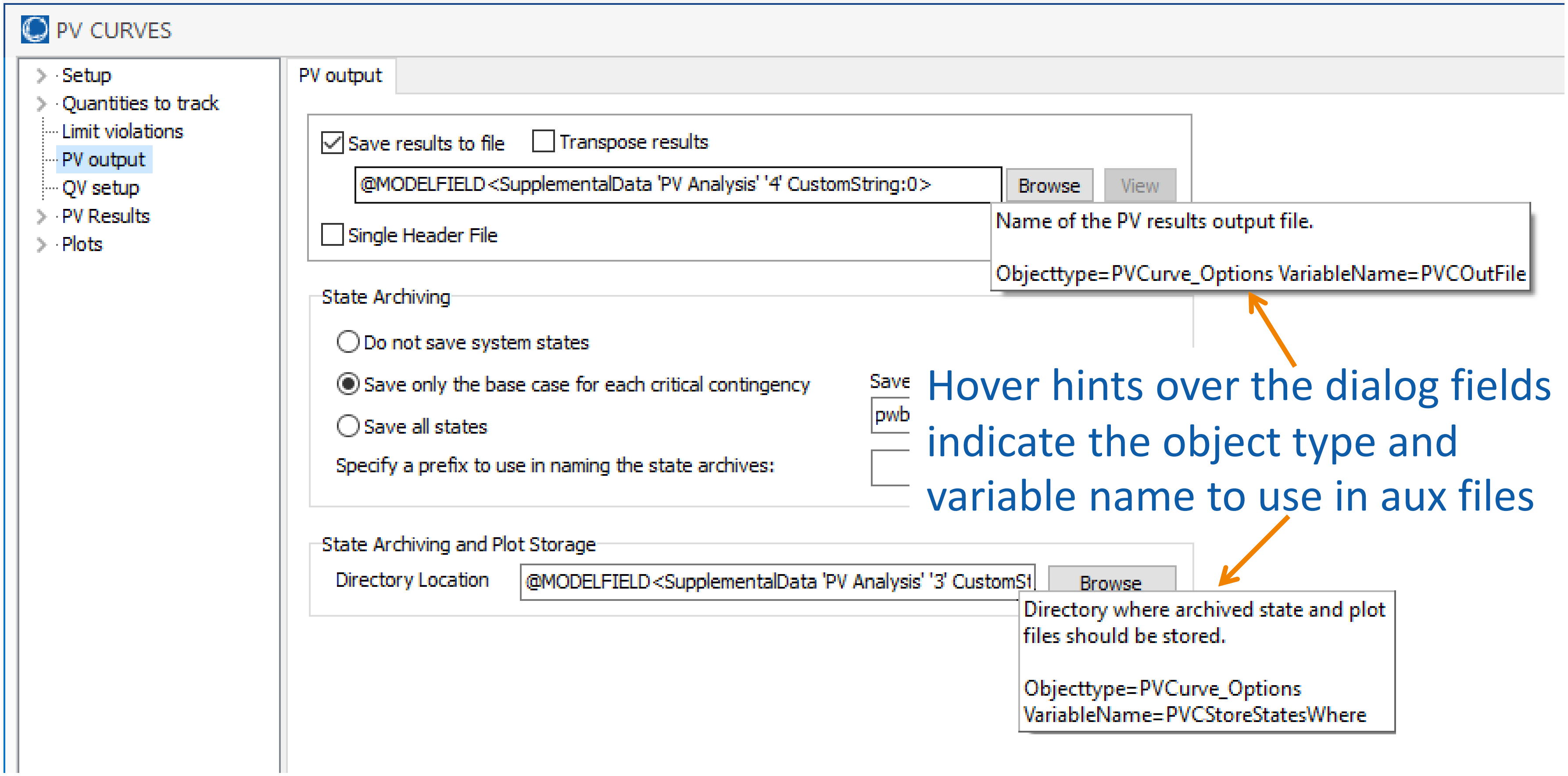
Remainder of file name, *_myoutput.CSV*, is remainder of the script command parameters that is not a keyword

Special Keywords in Field Values

- These are the exceptions because generally the special keywords are only used in file names and text fields as parameters in script commands
- The fields where this is allowed currently only include fields that specify output file names or directories
- The keywords will be converted at the time that the fields are accessed to determine the name of the directory or file
- The following fields can include the special keywords (these will also show up in relevant dialog fields in the GUI)
  - Transient_Options: ExpDirectory
  - PVCurve_Options: PVCOutFile, PVCStoreStatesWhere
  - QVCurve_Options: QVOutputDir
  - CTG_Options: CTGPostSolAuxFile, PostPostAuxFile, CTGResultStorageFile:1
  - Contingency: PostCTGAuxFile
  - Sim_Environment_Options: SEOSpecifiedAUXFile:0, SEOSpecifiedAUXFile:1, SEOSpecifiedAUXFile:2
  - MessLog_Options: LogAutoFileName

© 2018 PowerWorld Corporation

Special Keywords in Field Values Example



PV CURVES

☑ Save results to file □ Transpose results

@MODELFIELD<SupplementalData 'PV Analysis' '4' CustomString:0>

□ Single Header File

Name of the PV results output file.

Objecttype=PVCurve_Options VariableName=PVCOutFile

State Archiving

○ Do not save system states

● Save only the base case for each critical contingency

○ Save all states

Specify a prefix to use in naming the state archives:

Hover hints over the dialog fields indicate the object type and variable name to use in aux files

State Archiving and Plot Storage

Directory Location @MODELFIELD<SupplementalData 'PV Analysis' '3' CustomSt

Directory where archived state and plot files should be stored.

Objecttype=PVCurve_Options VariableName=PVCStoreStatesWhere

```
PVCurve_Options (PVCOutFile,PVCStoreStatesWhere)
{
"@MODELFIELD<SupplementalData 'PV Analysis' '4' CustomString:0>" "@MODELFIELD<SupplementalData 'PV Analysis' '3' CustomString:0>"
}
```

© 2018 PowerWorld Corporation

Specifying Field Values

- When setting the value of a field other fields can be referenced by using special formatting
- The following can be used in script commands and data sections
  - `"@variablename:location:digits:decimals"`
    - Sets the field to another field within the same object
  - `"&ModelExpressionName:digits:decimals"`
    - Sets the field to the result of a model expression
  - `"&objecttype 'key fields' variablename:location:digits:decimals"`
    - Sets the field to the value of the specified field for the specified object

Specifying Field Values

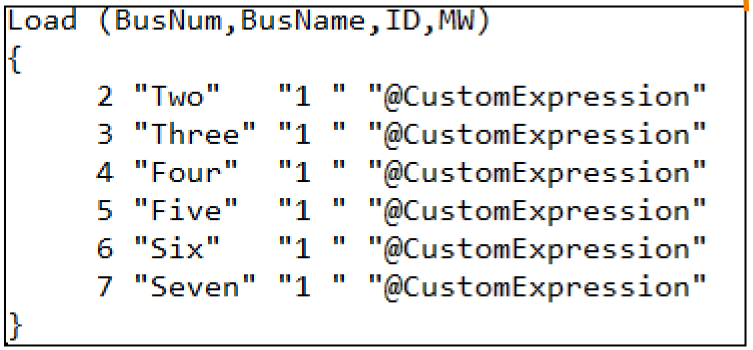
- `digits` specifies the total number of digits
  - Default is 32
- `decimal` specifies the digits to the right of the decimal
  - Default is 16
- When using <u>concise</u> variable names both `digit` and `decimal` must be specified if specified at all
  - `location` can be omitted whether or not `digit` and `decimal` are specified
- When using <u>legacy</u> variable names `location`, `digit`, and `decimal` can be omitted but the previous parameters must be specified for a given parameter to be included

© 2018 PowerWorld Corporation

Specifying Field Values Examples

```
SetData(Load, [MW], ["@CustomExpression"], ALL);
```

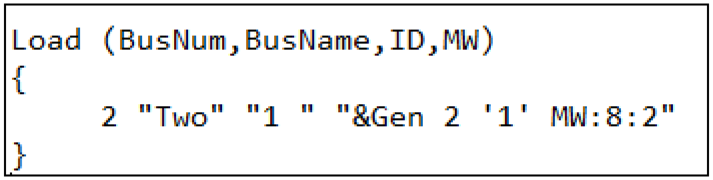
Set the MW value of all loads to the custom expression result for that load



```
Load (BusNum,BusName,ID,MW)
{
      2 "Two"   "1 " "@CustomExpression"
      3 "Three" "1 " "@CustomExpression"
      4 "Four"  "1 " "@CustomExpression"
      5 "Five"  "1 " "@CustomExpression"
      6 "Six"   "1 " "@CustomExpression"
      7 "Seven" "1 " "@CustomExpression"
}
```

```
SetData(Load, [MW], ["&Gen 2 '1' MW:8:2"], "<Device>Load 2 '1'");
```

Set the MW value of the load at bus 2 with ID = 1 to the MW output of the generator at bus 2 with ID = 1



```
Load (BusNum,BusName,ID,MW)
{
      2 "Two" "1 " "&Gen 2 '1' MW:8:2"
}
```

© 2018 PowerWorld Corporation

Filtering

- Many script commands take a filter as input to determine the objects on which the command acts
- Valid filter parameters are typically
  - "*FilterName*"
    - Name of Advanced Filter, Device Filter, or Secondary Filter (filtering across object types)
  - AREAZONE
    - Filter based on the area/zone/owner filter
  - SELECTED
    - Filter based on the Selected field = YES
  - ALL
    - Special filter for some script commands to include all objects of a specified object type

Filtering

- Device Filter
  - Instead of creating an Advanced Filter to return a particular object, reference the object directly through the device filter syntax
    - `"<DEVICE>objecttype 'key1' 'key2' 'key3’”`

```
SetData(Load, [MW], ["&Gen 2 '1' MW:8:2"], "<Device>Load 2 '1'");
```

Set the MW value of the load at bus 2 with ID = 1 to the MW output of the generator at bus 2 with ID = 1

Filtering

- Filtering Across Object Types (Secondary Filter)
  - Reference an Advanced Filter for a different object type than the object being filtered
  - Allows reuse of filters
    - Example: define a bus filter and then use this to filter generators, loads, switched shunts, branches, or any other object that connects to a bus
    - If the object being filtered contains more than one of the filter object type OR is assumed
      - If a bus object is being filtered based on an area filter, the bus meets the filter if the area of the bus meets the filter
      - If an area object is being filtered based on a bus filter, the area meets the filter if ANY single bus in the area meets the filter
  - `"<objecttype>filtername"`

```
SetData(Load, [MW], ["@CustomExpression"], "<Bus>Nom kV > 138");
```

Set the MW value of a load if the terminal bus of the load meets the filter

© 2018 PowerWorld Corporation

User Interface During Scripting

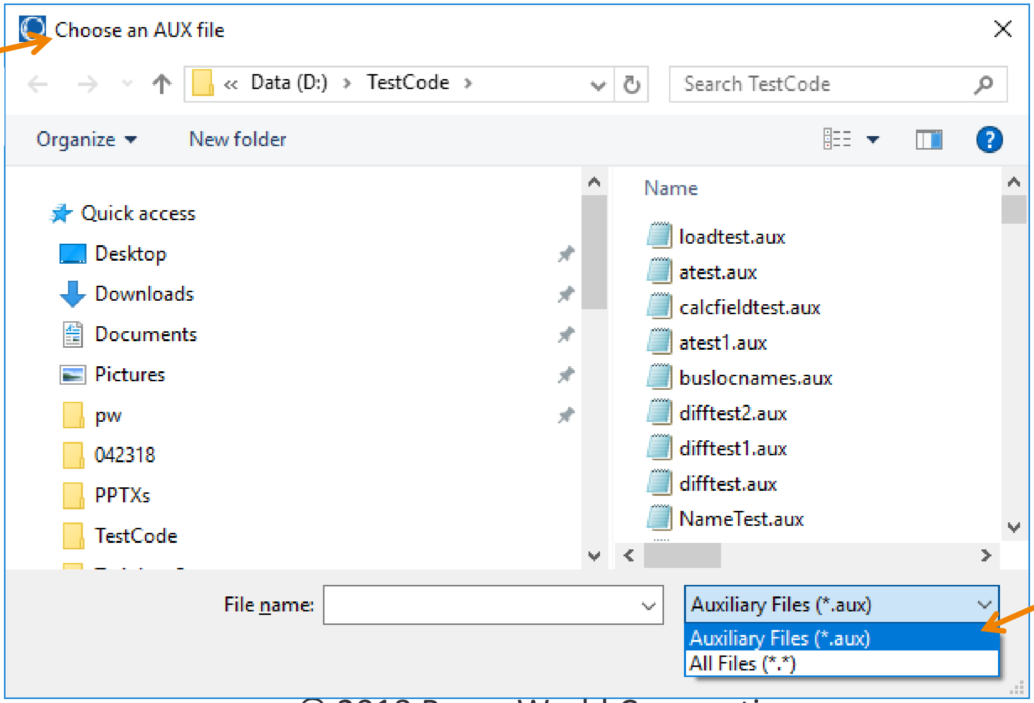
- Auxiliary file scripting is a batch process with no looping structure or condition checks
- The intention is to load an auxiliary file and walk away
- There are a few script commands and special syntax that allow user interaction with a GUI dialog during the scripting

© 2018 PowerWorld Corporation

GUI During Scripting

- Special syntax within the `filename` parameter in script commands will open a dialog to choose a file
  - `"<PROMPT 'Caption' 'FileTypes'>"`

```
LoadAux("<PROMPT 'Choose an AUX file' 'Auxiliary Files
(*.aux)|*.aux|All Files (*.*)|*.*'>");
```



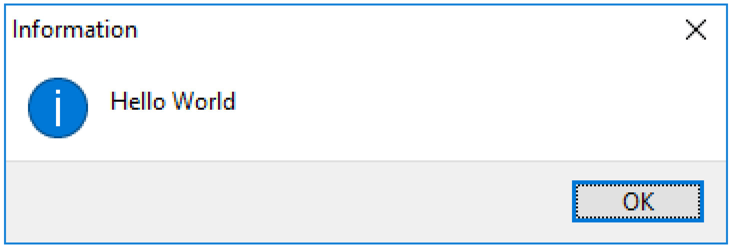
Specified **Caption**

Specified **FileTypes**

GUI During Scripting

- `MessageBox("text");`
  - Provide a simple text message to the user with no user input to the scripting

```
MessageBox("Hello World");
```



Information

Hello World

GUI During Scripting

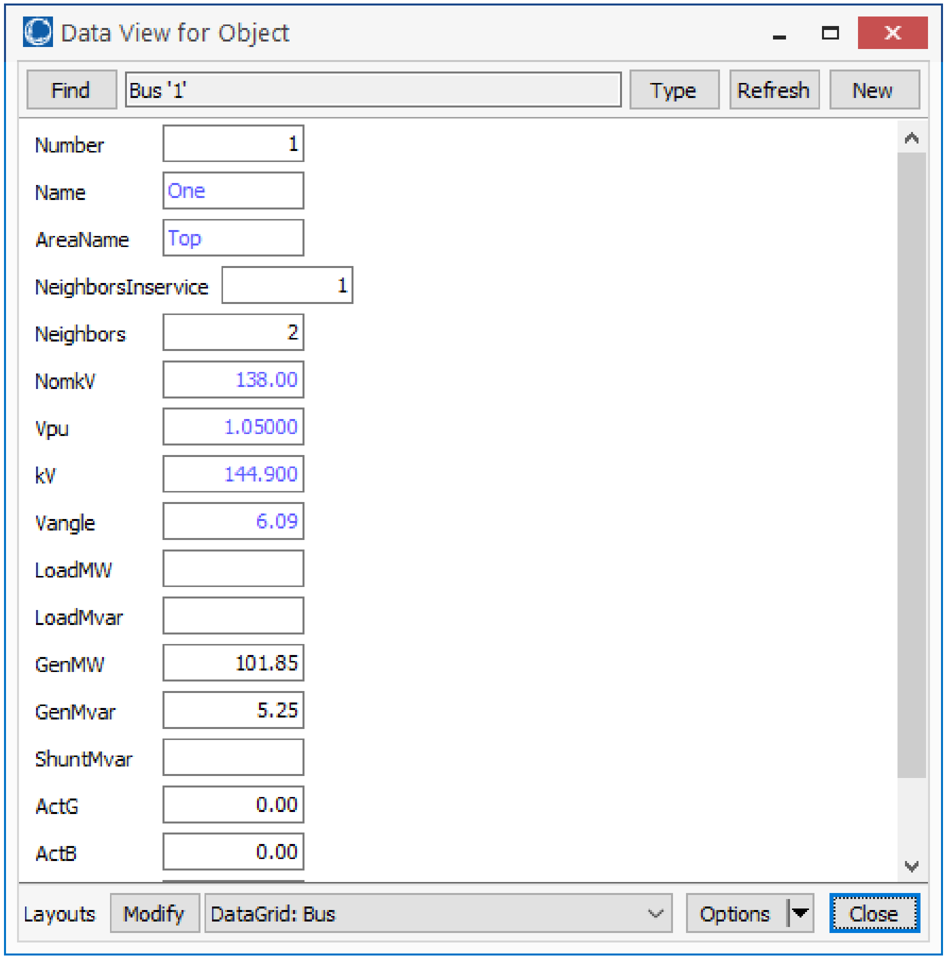
- `OpenDataView("ObjectIDString", "DataGridIDString");`
  - Use the Data View feature to display a dialog during scripting that will allow fields to be changed for a single object in a manner similar to how they are changed in a case information display
  - See the help documentation for full details on how to customize these data views
    - https://www.powerworld.com/WebHelp/Default.htm#MainDocumentation_HTML/Data_View.htm

© 2018 PowerWorld Corporation

GUI During Scripting

```
OpenDataView("Bus 1", "DataGrid 'Bus'");
```

- Opens a dialog containing the same fields that are displayed in the Bus case information display in the Model Explorer
- Color coding for field values is the same as in a case information display
- User can change values for the fields that can be edited



Data View for Object

Bus '1'

Number	1
Name	One
AreaName	Top
NeighborsInservice	1
Neighbors	2
NomkV	138.00
Vpu	1.05000
kV	144.900
Vangle	6.09
LoadMW	
LoadMvar	
GenMW	101.85
GenMvar	5.25
ShuntMvar	
ActG	0.00
ActB	0.00

DataGrid: Bus

© 2018 PowerWorld Corporation

GUI During Scripting

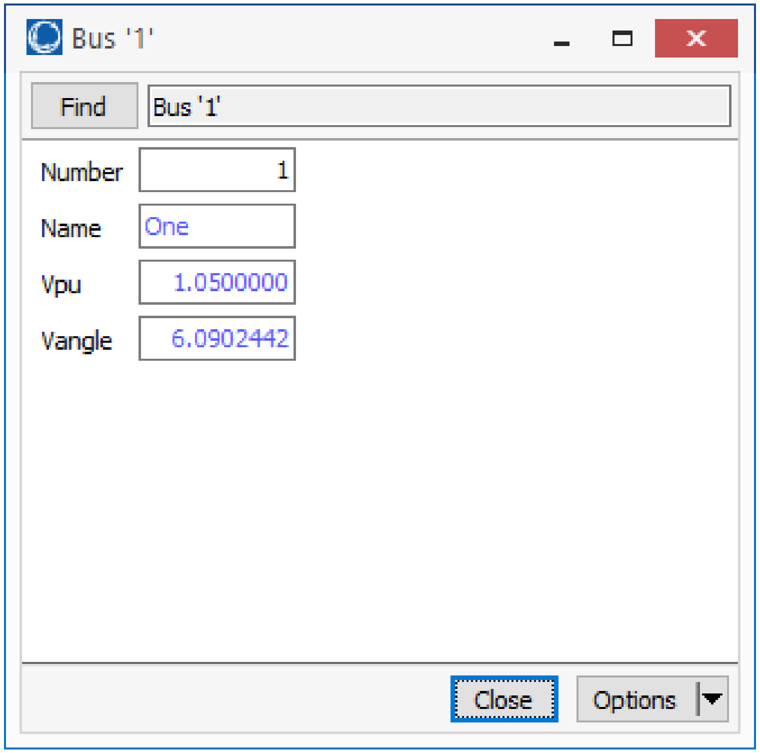
- `ObjectFieldsInputDialog("ObjectIDString",[fieldlist], lots of optional parameters);`
  - Create a custom dialog for displaying fields for a particular object without having to define a DataGrid object
  - See help documentation for details on how to specify the `lots of optional parameters`
    - https://www.powerworld.com/WebHelp/Content/Other_Documents/Auxiliary-File-Format.pdf

© 2018 PowerWorld Corporation

GUI During Scripting

```
ObjectFieldsInputDialog("Bus 1",[Number, Name, Vpu,
Vangle]);
```

- Opens a dialog containing the fields defined in the script command
- Color coding for field values is the same as in a case information display
- User can change values for the fields that can be edited



Bus '1'

Number 1

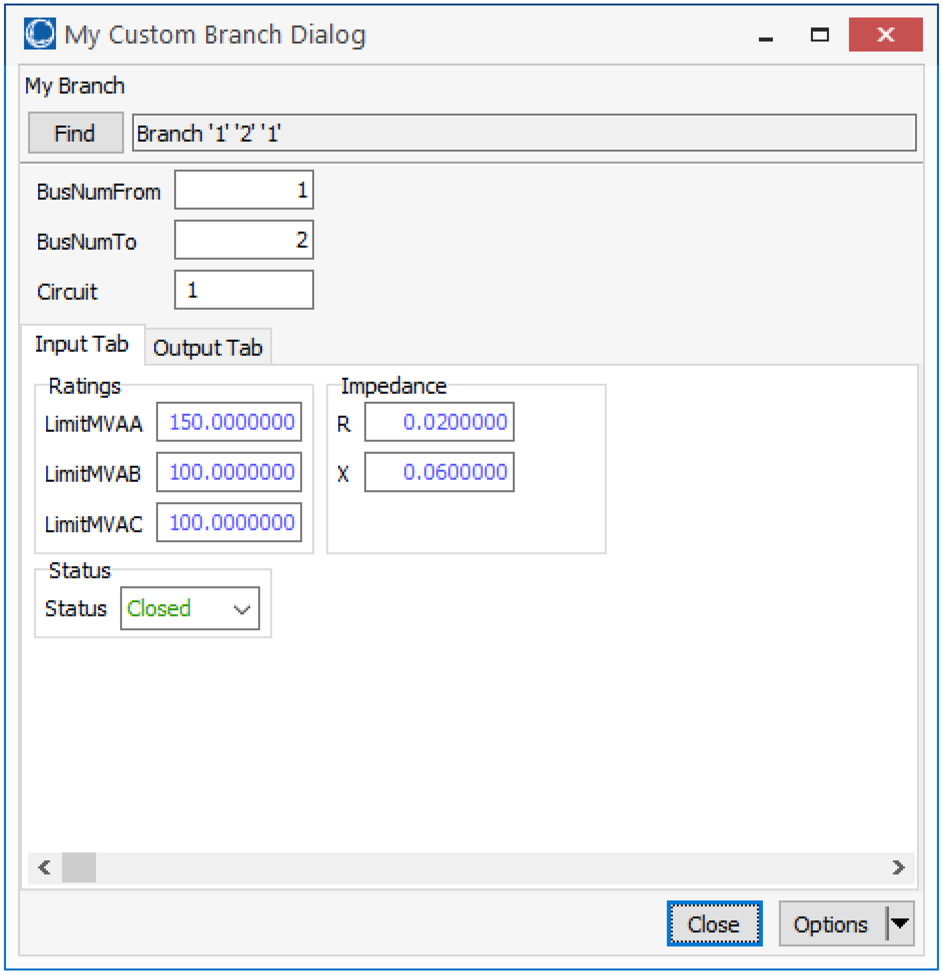
Name One

Vpu 1.0500000

Vangle 6.0902442

GUI During Scripting

```
ObjectFieldsInputDialog("Branch 1
2 1", [BusNumFrom, BusNumTo,
Circuit, LimitMVAA, LimitMVAB,
LimitMVAC, R, X, Status, MWFrom,
MWTo, MvarFrom, MvarTo, MVAFrom,
MVATo], "My Custom Branch
Dialog", "My Branch", [], [3, 9],
["Input Tab","Output Tab"],
[3,8,9,13],
["Ratings","Status","MW","MVA"],
[6,11], ["Impedance","Mvar"]);
```



Branch '1' '2' '1'

BusNumFrom 1

BusNumTo 2

Circuit 1

LimitMVAA 150.0000000

LimitMVAB 100.0000000

LimitMVAC 100.0000000

R 0.0200000

X 0.0600000

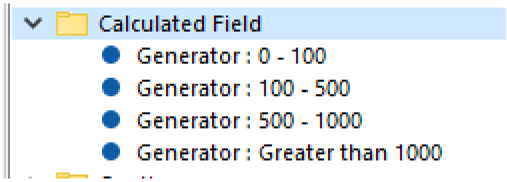
Status Closed

Calculated Fields

- Provide a way of performing an arithmetic operation on a group of objects of a single object type based on a specific field
- This calculation can then be applied to objects of a different object type
- The final results are based on how the object type in the calculated field definition relates to the object type to which the calculation is applied
  - Define a calculation on the branch object type and then apply this to the bus object type. The final result that is displayed with a bus will perform the calculation on all branches that have at least one terminal connected to that bus.

Calculated Fields Example

- Total Max MW of generators by range
  - Define calculated fields for the ranges of generators: 0 – 100 MW, 100 – 500 MW, 500 – 1000 MW, greater than 1000 MW
- Calculated fields will show up in the list of available fields for all applicable object types



- Calculated Field
  - Generator : 0 - 100
  - Generator : 100 - 500
  - Generator : 500 - 1000
  - Generator : Greater than 1000

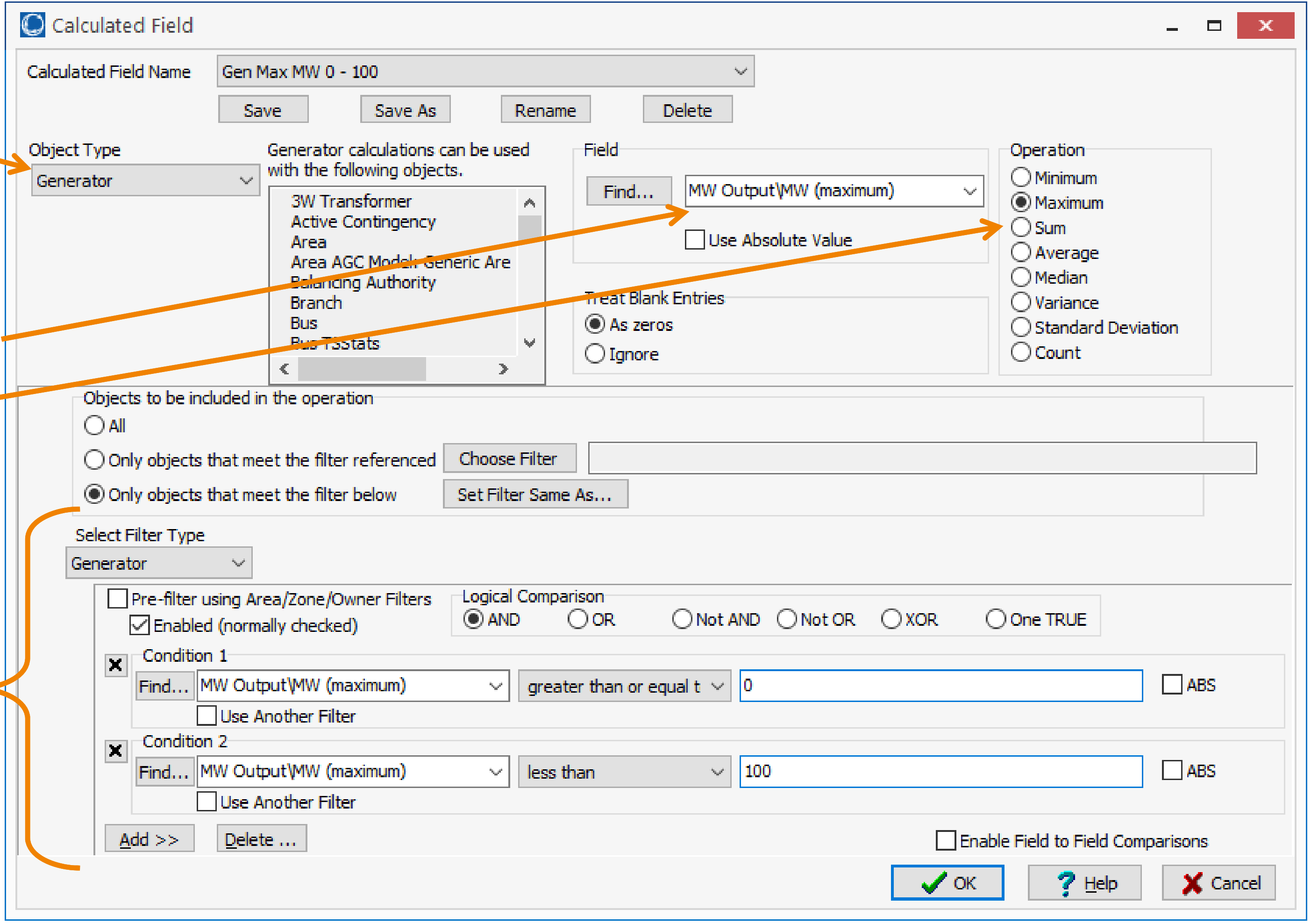
© 2018 PowerWorld Corporation

Calculated Fields Example

Object Type on which the calculation is performed

Field and Operation being applied

Filter is applied to the objects of Object Type to determine which ones are included in the calculation



Calculated Field

Calculated Field Name: Gen Max MW 0 - 100

Object Type: Generator

Generator calculations can be used with the following objects.

- 3W Transformer
- Active Contingency
- Area
- Area AGC Model: Generic Are
- Balancing Authority
- Branch
- Bus
- Bus TSStats

Field: MW Output\MW (maximum)

☐ Use Absolute Value

Treat Blank Entries
● As zeros
○ Ignore

Operation
○ Minimum
● Maximum
○ Sum
○ Average
○ Median
○ Variance
○ Standard Deviation
○ Count

Objects to be included in the operation
○ All
○ Only objects that meet the filter referenced
● Only objects that meet the filter below

Select Filter Type: Generator

☐ Pre-filter using Area/Zone/Owner Filters
☑ Enabled (normally checked)

Logical Comparison
● AND ○ OR ○ Not AND ○ Not OR ○ XOR ○ One TRUE

Condition 1
MW Output\MW (maximum) | greater than or equal t | 0 | ☐ ABS
☐ Use Another Filter

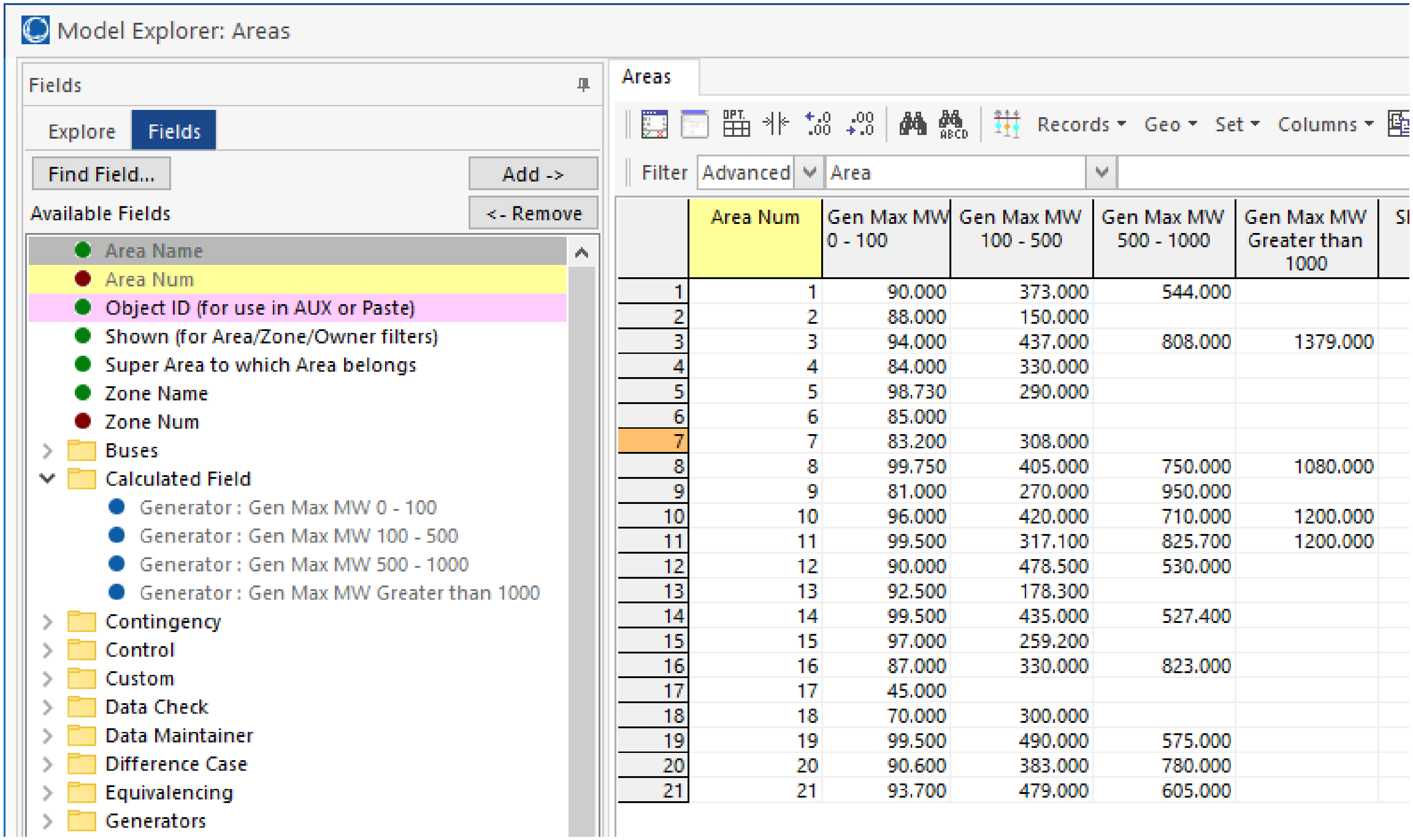
Condition 2
MW Output\MW (maximum) | less than | 100 | ☐ ABS
☐ Use Another Filter

☐ Enable Field to Field Comparisons

© 2018 PowerWorld Corporation

Calculated Fields Example

When used with Area object type, the calculated results give the total Max MW of all generators in each area within the specified MW range



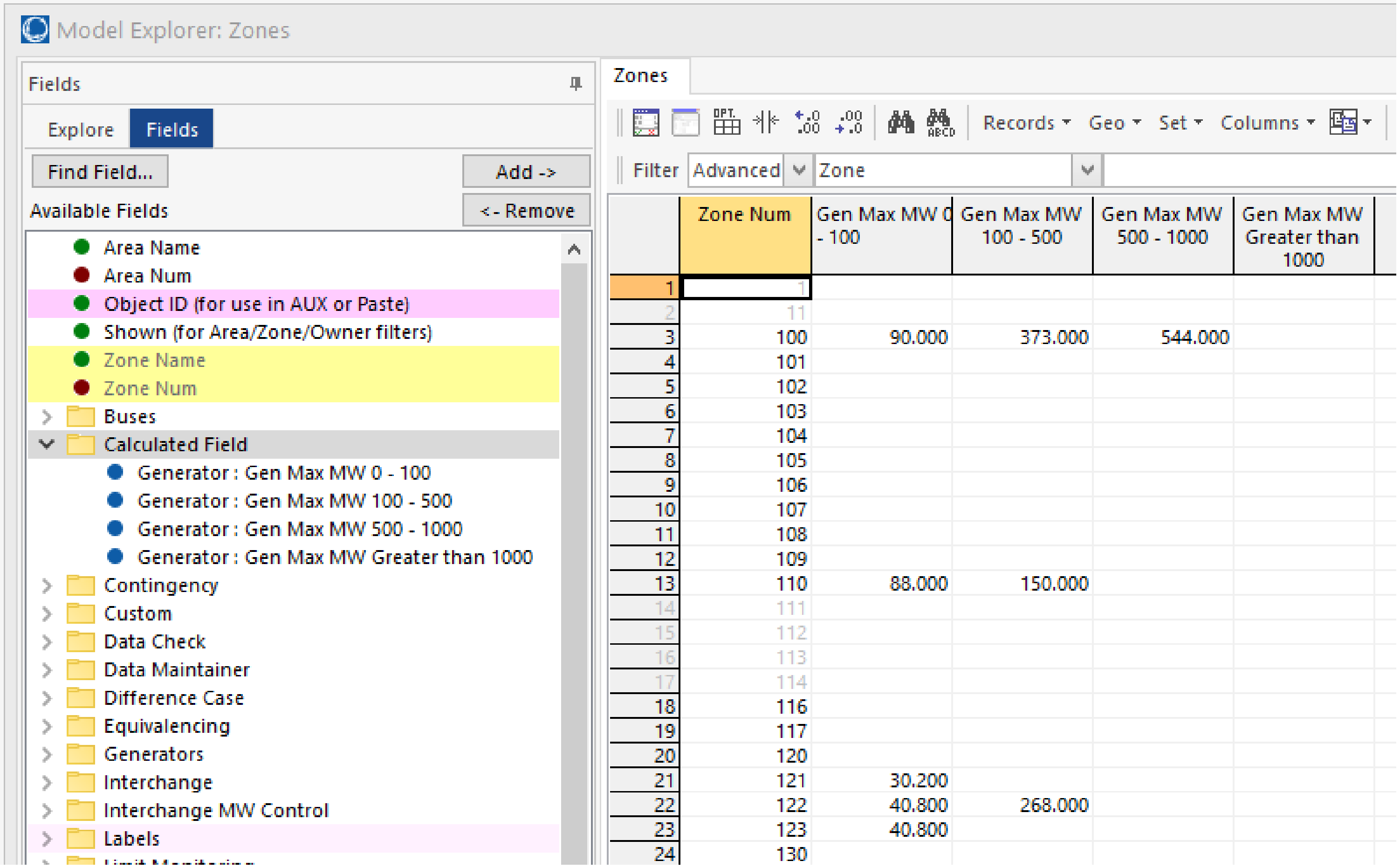
- ● Area Name
- ● Area Num
- ● Object ID (for use in AUX or Paste)
- ● Shown (for Area/Zone/Owner filters)
- ● Super Area to which Area belongs
- ● Zone Name
- ● Zone Num
- Buses
- Calculated Field
  - ● Generator : Gen Max MW 0 - 100
  - ● Generator : Gen Max MW 100 - 500
  - ● Generator : Gen Max MW 500 - 1000
  - ● Generator : Gen Max MW Greater than 1000
- Contingency
- Control
- Custom
- Data Check
- Data Maintainer
- Difference Case
- Equivalencing
- Generators

	Area Num	Gen Max MW 0 - 100	Gen Max MW 100 - 500	Gen Max MW 500 - 1000	Gen Max MW Greater than 1000	SI
1	1	90.000	373.000	544.000		
2	2	88.000	150.000			
3	3	94.000	437.000	808.000	1379.000	
4	4	84.000	330.000			
5	5	98.730	290.000			
6	6	85.000				
7	7	83.200	308.000			
8	8	99.750	405.000	750.000	1080.000	
9	9	81.000	270.000	950.000		
10	10	96.000	420.000	710.000	1200.000	
11	11	99.500	317.100	825.700	1200.000	
12	12	90.000	478.500	530.000		
13	13	92.500	178.300			
14	14	99.500	435.000	527.400		
15	15	97.000	259.200			
16	16	87.000	330.000	823.000		
17	17	45.000				
18	18	70.000	300.000			
19	19	99.500	490.000	575.000		
20	20	90.600	383.000	780.000		
21	21	93.700	479.000	605.000		

© 2018 PowerWorld Corporation

Calculated Fields Example

When used with Zone object type, the calculated results give the total Max MW of all generators in each zone within the specified MW range



Available Fields

- Area Name
- Area Num
- Object ID (for use in AUX or Paste)
- Shown (for Area/Zone/Owner filters)
- Zone Name
- Zone Num
- Buses
- Calculated Field
  - Generator : Gen Max MW 0 - 100
  - Generator : Gen Max MW 100 - 500
  - Generator : Gen Max MW 500 - 1000
  - Generator : Gen Max MW Greater than 1000
- Contingency
- Custom
- Data Check
- Data Maintainer
- Difference Case
- Equivalencing
- Generators
- Interchange
- Interchange MW Control
- Labels

Filter: Advanced | Zone

	Zone Num	Gen Max MW 0 - 100	Gen Max MW 100 - 500	Gen Max MW 500 - 1000	Gen Max MW Greater than 1000
1	1				
2	11				
3	100	90.000	373.000	544.000	
4	101				
5	102				
6	103				
7	104				
8	105				
9	106				
10	107				
11	108				
12	109				
13	110	88.000	150.000		
14	111				
15	112				
16	113				
17	114				
18	116				
19	117				
20	120				
21	121	30.200			
22	122	40.800	268.000		
23	123	40.800			
24	130				

© 2018 PowerWorld Corporation

Calculated Fields

- Other examples
  - Return the buses in the island with the most buses
  - Set the system slack bus based on generator criteria
  - Maximum percent flow on all branches in an area or zone
  - Trip injection group with largest output
  - GIC flows in a substation
  - Losses by owner and nominal kV level
  - PV results with the lowest transfer level

© 2018 PowerWorld Corporation

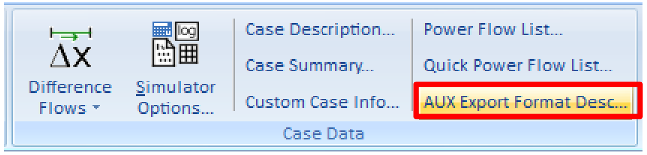
Auxiliary File Export Format Descriptions

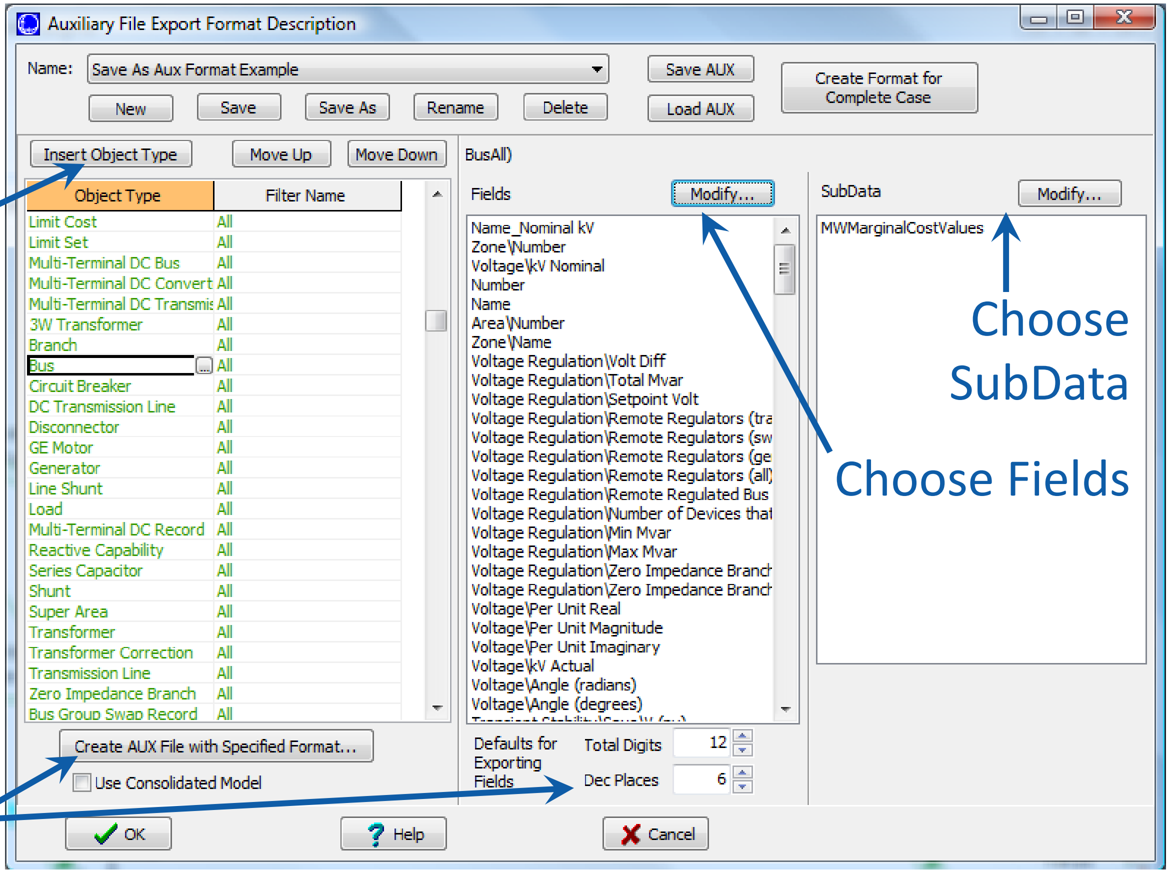
- Allows you to define a list of DATA sections and fields you would like to write out to an auxiliary file
- These formats themselves can then be saved to an auxiliary file and used whenever needed
- The following options define an aux export format
  - Object Type: Specify type of object
  - Filter Name: *All*, *Selected*, *AreaZone*, the name of an Advanced Filter in quotes, or a Filter Condition. Allows you to specify objects for which to write data.
  - Fields: a list of all fields to be written for this object
  - SubData: a list of sub-data sections to write for each object
- Script command can be used to save an auxiliary file in a defined format
  - SaveDataUsingExportFormat("filename", filetype, "FormatName");

© 2018 PowerWorld Corporation

Auxiliary File Export Format Descriptions

- On the Case Information Ribbon Tab, click **AUX Export Format Desc…**





Auxiliary File Export Format Description
New
Save
Save As
Rename
Delete
Save AUX
Load AUX
Create Format for Complete Case
Insert Object Type
Move Up
Move Down
Modify...
Modify...
Create AUX File with Specified Format...
OK
Help
Cancel

Name: Save As Aux Format Example

BusAll)

Object Type	Filter Name
Limit Cost	All
Limit Set	All
Multi-Terminal DC Bus	All
Multi-Terminal DC Convert	All
Multi-Terminal DC Transmis	All
3W Transformer	All
Branch	All
Bus	All
Circuit Breaker	All
DC Transmission Line	All
Disconnector	All
GE Motor	All
Generator	All
Line Shunt	All
Load	All
Multi-Terminal DC Record	All
Reactive Capability	All
Series Capacitor	All
Shunt	All
Super Area	All
Transformer	All
Transformer Correction	All
Transmission Line	All
Zero Impedance Branch	All
Bus Group Swap Record	All

Fields

Name_Nominal kV
Zone\Number
Voltage\kV Nominal
Number
Name
Area\Number
Zone\Name
Voltage Regulation\Volt Diff
Voltage Regulation\Total Mvar
Voltage Regulation\Setpoint Volt
Voltage Regulation\Remote Regulators (tra
Voltage Regulation\Remote Regulators (sw
Voltage Regulation\Remote Regulators (ge
Voltage Regulation\Remote Regulators (all)
Voltage Regulation\Remote Regulated Bus
Voltage Regulation\Number of Devices that
Voltage Regulation\Min Mvar
Voltage Regulation\Max Mvar
Voltage Regulation\Zero Impedance Branch
Voltage Regulation\Zero Impedance Branch
Voltage\Per Unit Real
Voltage\Per Unit Magnitude
Voltage\Per Unit Imaginary
Voltage\kV Actual
Voltage\Angle (radians)
Voltage\Angle (degrees)

SubData

MWMarginalCostValues

Defaults for Exporting Fields: Total Digits 12; Dec Places 6

☐ Use Consolidated Model

Choose Object Types

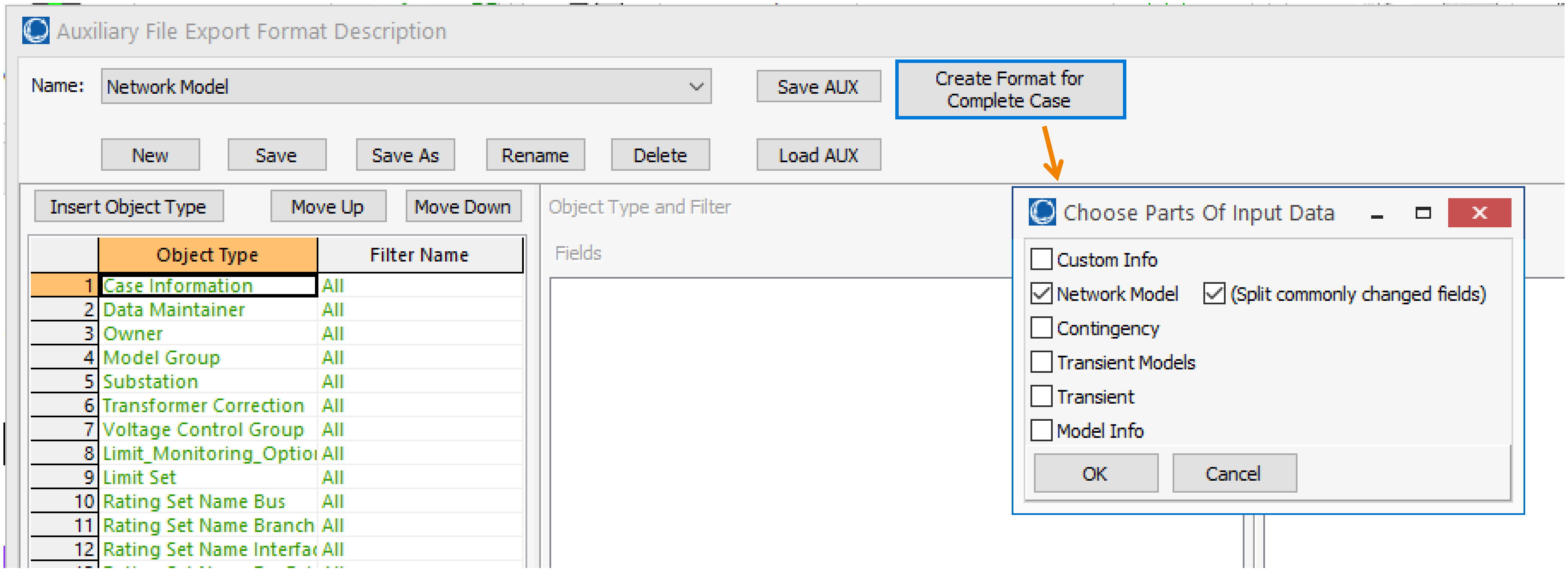
Choose SubData

Choose Fields

Set formatting and file type

Auxiliary File Export Format Descriptions

- Default formats can be used as a starting point for customizations



Name: Network Model

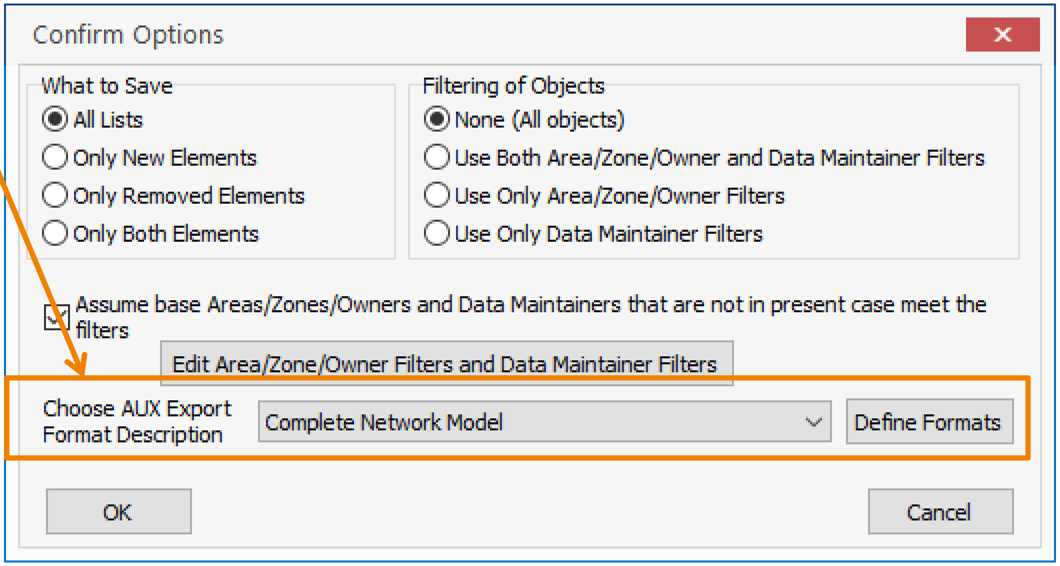
	Object Type	Filter Name
1	Case Information	All
2	Data Maintainer	All
3	Owner	All
4	Model Group	All
5	Substation	All
6	Transformer Correction	All
7	Voltage Control Group	All
8	Limit_Monitoring_Optio	All
9	Limit Set	All
10	Rating Set Name Bus	All
11	Rating Set Name Branch	All
12	Rating Set Name Interfa	All

Choose Parts Of Input Data

□ Custom Info
☑ Network Model ☑ (Split commonly changed fields)
□ Contingency
□ Transient Models
□ Transient
□ Model Info

Auxiliary File Export Format Descriptions

- AUX export formats can be used with Present Case Topological Differences from the Base Case dialog to customize fields and objects saved



Confirm Options

What to Save
- ● All Lists
- ○ Only New Elements
- ○ Only Removed Elements
- ○ Only Both Elements

Filtering of Objects
- ● None (All objects)
- ○ Use Both Area/Zone/Owner and Data Maintainer Filters
- ○ Use Only Area/Zone/Owner Filters
- ○ Use Only Data Maintainer Filters

☑ Assume base Areas/Zones/Owners and Data Maintainers that are not in present case meet the filters

Choose AUX Export Format Description: Complete Network Model

© 2018 PowerWorld Corporation