Introduction to PowerWorld Simulator: Interface and Common Tools

I4: Auxiliary File Format: DATA Section

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Auxiliary Files

- PowerWorld Simulator data can be stored and edited in a text file format
- A scripting language is available for modifying data and automatically running PowerWorld Simulator commands
- The auxiliary (*.aux) file format accomplishes both functions
- The auxiliary file format also extends to oneline diagrams (*.axd) except for a different set of script commands

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What Can You DO with Auxiliary Files?

- Quality Assurance: Standardize settings and controls for multiple cases and studies
- Customize Simulator environment
- Document
  - Describe an analysis procedure for a manager or client
  - Create a detailed project record
  - Enable reproducibility
- Automate detailed calculations and storage of the results
- Automate building and editing of a oneline diagram

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Example: Using Aux Files to Customize Simulator Environment

- Automatically load aux file each time a case is loaded
- Allows standardization of options
- Use to customize
  - Area/Zone/Owner Filters
  - Advanced Filters
  - Custom Expressions
  - Custom Data Grids
  - Many more
- Sample file series
  - *I04_Auxiliary File Data Section\aux30?0*.aux*
  - *aux3000Defaults.aux* loads the other files
  - Intended to work with *ACTIVSg25k.pwb*

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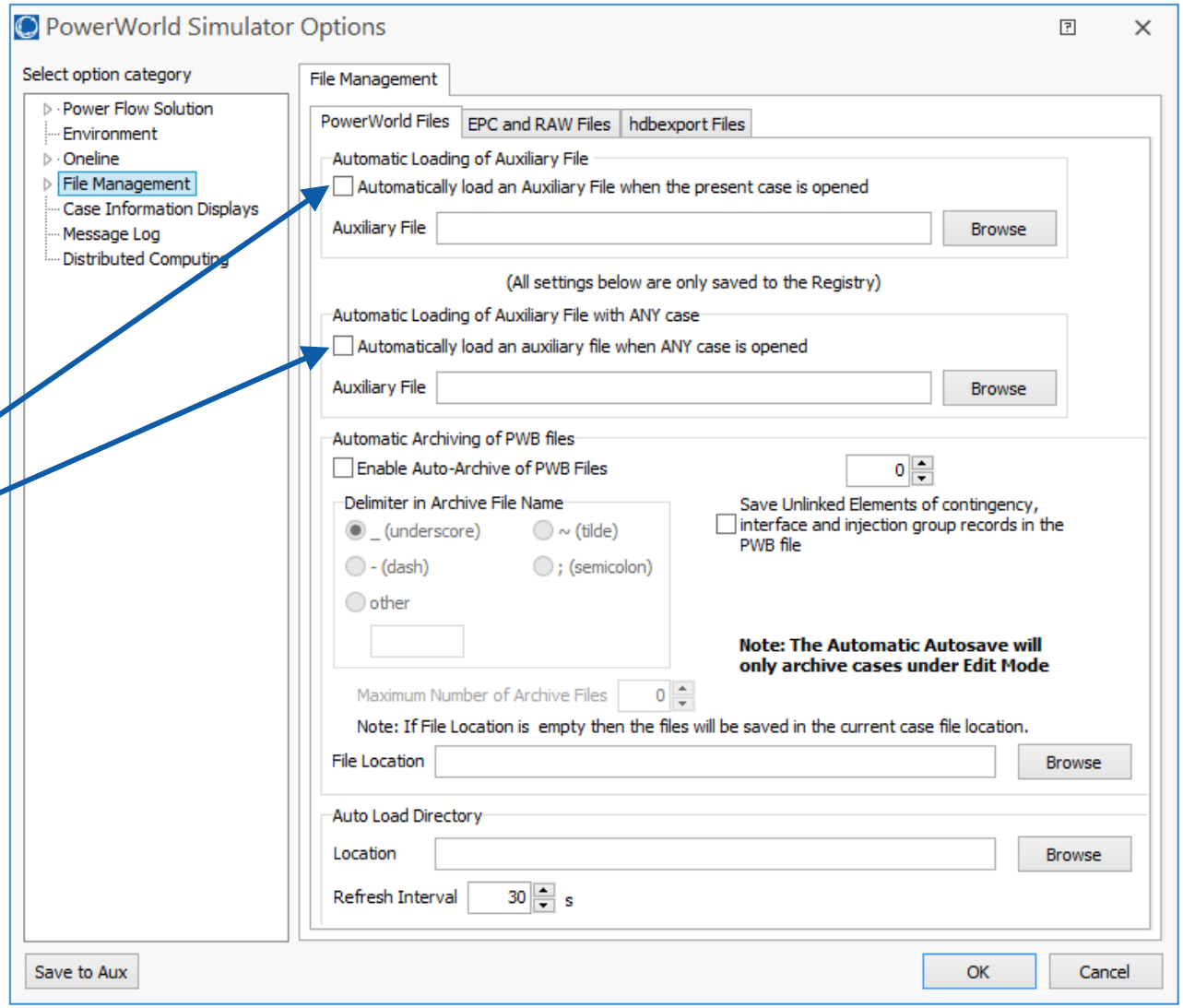
Automatically Load File

Load a file for PRESENT case or ANY case



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Auxiliary File Format Overview

- Has two types of “Sections”
  - There is no limit to the number of sections in a file

SCRIPT Section

```
SCRIPT ScriptName1
{
script_statement_1;
   :
script_statement_n;
}
```

DATA Section

```
object_type DataName1(list_of_fields)
{
data_list_1
   :
data_list_n
}
```

DATA Section

```
object_type DataName2(list_of_fields)
{
data_list_1
   :
data_list_n
}
```

SCRIPT Section

```
SCRIPT ScriptName2
{
script_statement_1;
   :
script_statement_n;
}
```


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Auxiliary File
SCRIPT Sections

- Start with the word SCRIPT
- An optional script name may follow
  - For use with the LoadScript Action
- Then a block of script actions follow enclosed in curly braces { }
- Each script statement must end in a semicolon ;
- All the script actions allowed will be covered in a later set of slides.

```
SCRIPT ScriptName1
{
script_statement_1;
   :
script_statement_n;
}
```


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Auxiliary File DATA Sections

- Start with a valid Object_Type string*
- An optional data name may follow
  - For use with the LoadData Action
- Following this is a list of fields enclosed in parenthesis
  - **(list_of_fields)**

```
object_type DataName1(list_of_fields)
{
data_list_1
   :
data_list_n
}
```

*Note: In the legacy format, DATA sections start with “DATA” string. Files in this format can still be loaded. DATA sections are saved in this format if the option “Use Concise Variable Names and Headers” in the Case Info Toolbar is unchecked.

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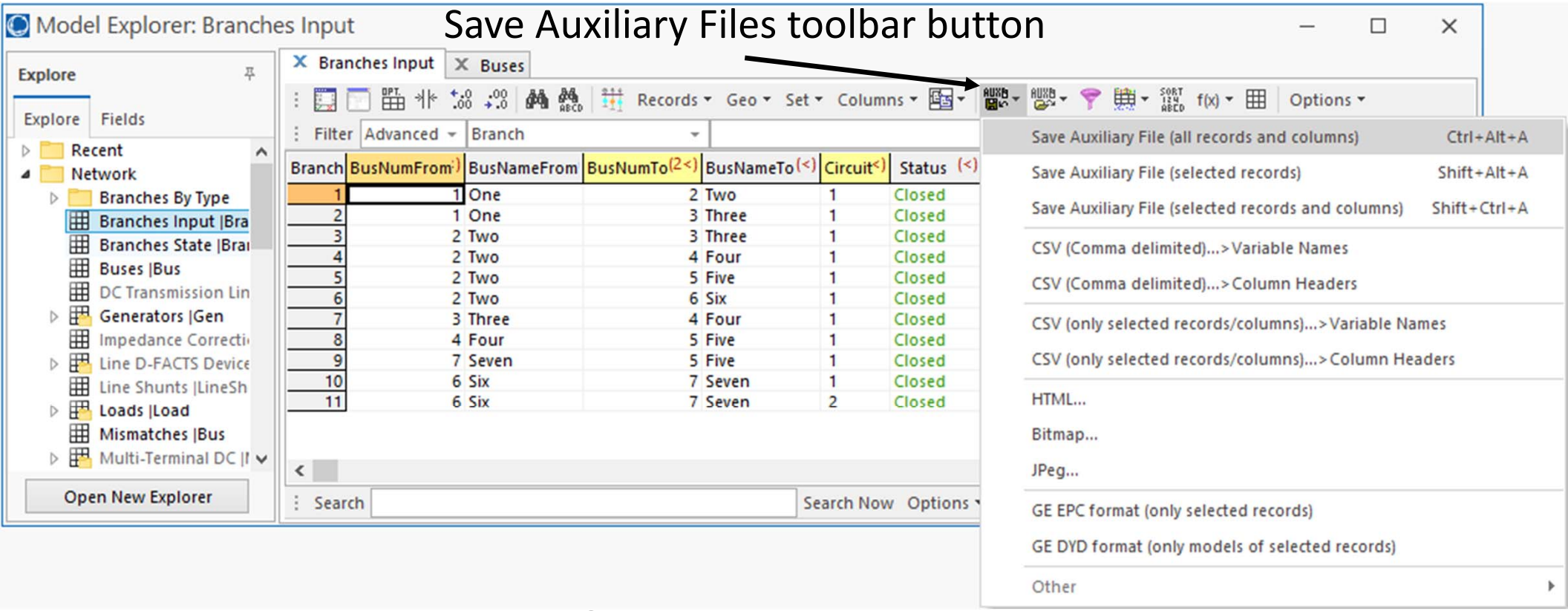
Creating an Auxiliary File

- Most grids in Simulator have an option to save data to an auxiliary file
  - Save Auxiliary Files toolbar button
  - Right-click and choose **Save As → Auxiliary File**



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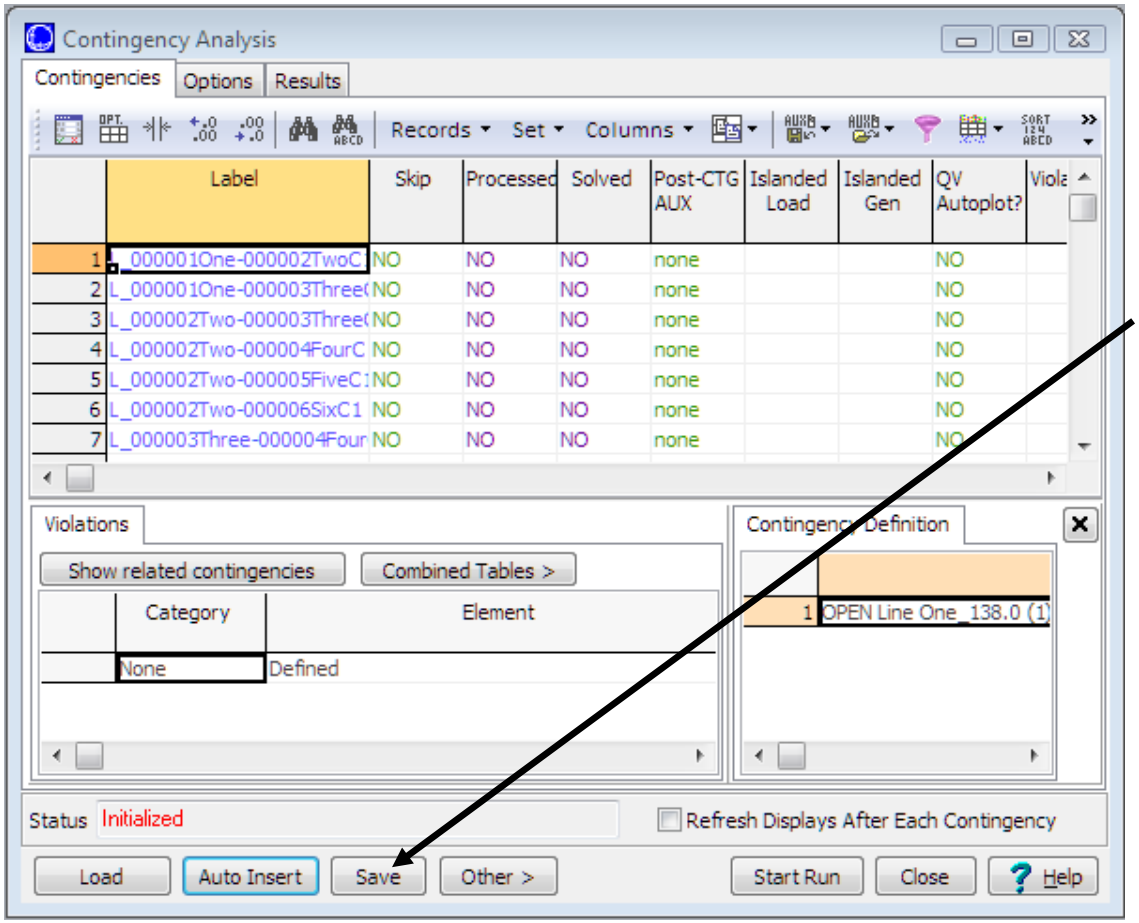
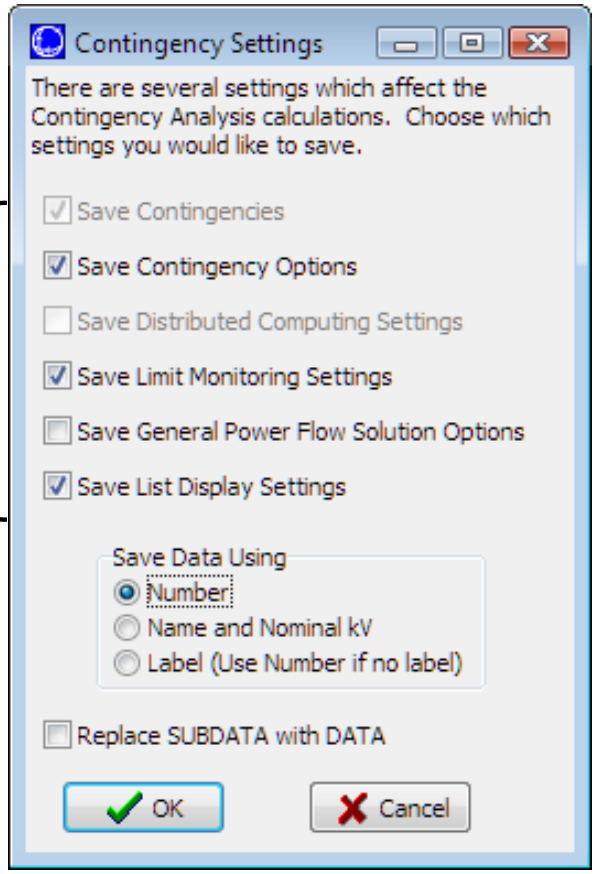
Creating an Auxiliary File

- Some dialogs have a Save button that will create an auxiliary file with all relevant information



Click Save, then get a prompt for what details to include



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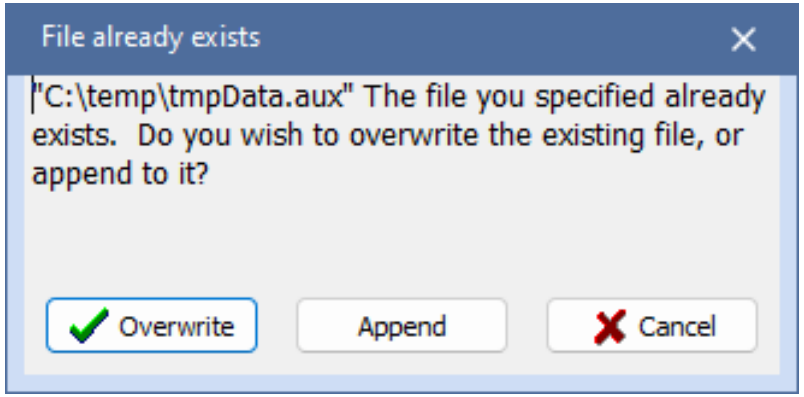
Creating an Auxiliary File

- Anytime you Save information to an auxiliary file, the subsequent file dialogs allow options to create a new file, overwrite an existing file, or append to an existing file



- You can thus progressively build files with multiple DATA sections

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DATA Section Object_Types

- Identifies the type of object or data element the DATA section describes or models
- Some examples include:

Area
ATC_Options
ATCExtraMonitor
ATCGeneratorChange
ATCInterfaceChange
ATCLineChange
ATCScenario
ATCZoneChange
BidCurve
Branch
Bus
ColumnInfo
Condition
Contingency
Ctg_Options
CTGElement
CustomExpression
DataGrid
DCTransmissionLine
Direction
Equiv_Options
Filter
Gen
InjectionGroup
Interface
InterfaceElement
Limit_Monitoring_Options
LimitSet
LimitViol
Load
LoadScale
ModelCondition
ModelFilter
MSLine
MWTransaction
OPF_Options
OwnerObject
PartPoint
PVCurve_Options
QVCurve_Options
ReactiveCapability
Scale_Options
Schedule
Shunt
Sim_Environment_Options
Sim_Misc_Options
Sim_Simulation_Options
Sim_Solution_Options
StudyMWTransactions
Substation
SuperArea
TransferLimiter
Transformer
XFCorrection
Zone

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DATA Section
list_of_fields

- Lists the types of values the records in the DATA section contain
- The order of the fields dictate the order that fields will be read from the DATA section
- Simulator recognizes over 10,000 total fields
  - Only a small subset will be used with a particular type of object
  - A list of available fields for each object type may be obtained on the Windows ribbon tab. On the Auxiliary Files ribbon group, choose **Export Case Object Fields → Text File** or **Send To Excel**

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DATA Section
list_of_fields Parameter

- Specifications for a list_of_fields
  - Enclosed in parentheses (brackets [] for legacy format)
  - May take up several lines of text
  - You may use the Simulator comment string //
    - Simulator will ignore all text to the right of the double slash
  - Blank lines, or lines which begin with the comment string will be ignored
  - Field Names must be separated by commas
  - Field Names may be optionally augmented with a field location integer (by default, we assume Location is 0)
    - Format is Fieldname:Location
    - CustomInteger:0 means get the first custom integer
    - CustomInteger:1 means get the second custom integer

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DATA Section
Key Fields

- Each object type has a few fields that serve as key fields for Simulator.
- These fields must be included in the list_of_fields.
  - Buses: Number
  - Lines: BusNumFrom, BusNumTo, Circuit
  - Loads: BusNum, ID
- You can get a list of the key fields by going to the Windows Ribbon Tab. On the Auxiliary Files Ribbon Group, choose **Export Case Object Fields → Text File** or **Send To Excel**
  - The key fields will be denoted in this output with asterisks (*1*, *2*, and *3*)

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DATA Section
Secondary Key Fields

- Secondary Key fields
  - Often represent a combination of Name/Nominal kV for bus-related objects
  - The secondary key fields will be denoted in this output with asterisks (*A*, *B*, and *C*)
- When pasting into Simulator, we first look to see if the key fields are available. If they are not, then we look for the secondary key fields and use them instead.
- NOTE: The fields that make up Secondary Keys are generally not immutable and may not be unique
  - A case may have multiple buses with the same name and nominal kV.
  - If you load an aux for an object type where this occurs, Simulator will change the data for only one such object with matching Secondary Key.
  - The Secondary Key should be used with caution and only as a heuristic for transferring data between different cases where the Primary Key is unreliable (e.g. bus numbers have changed).

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Labels

- Unique identifier for an object of a particular type
- Refer to equipment in the model in a way unique to your organization
- Likely to change less frequently that bus numbers
- Can be used for pasting and updating
  - Label (for use in input from AUX or Paste)

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DATA Section
Required Fields

- You can also create new objects by reading in data from the DATA Section of an AUX file.
- Be careful. You must provide all Key AND **Required Fields** regarding the object.
  - e.g. To create a bus, include Number, Name, Nominal kV, Area Number, and Zone Number.
- Required Fields can be highlighted in green by using the Highlight Key/Required fields options.
  - In the Display/Column Options
  - In the Headings caption of the case info display

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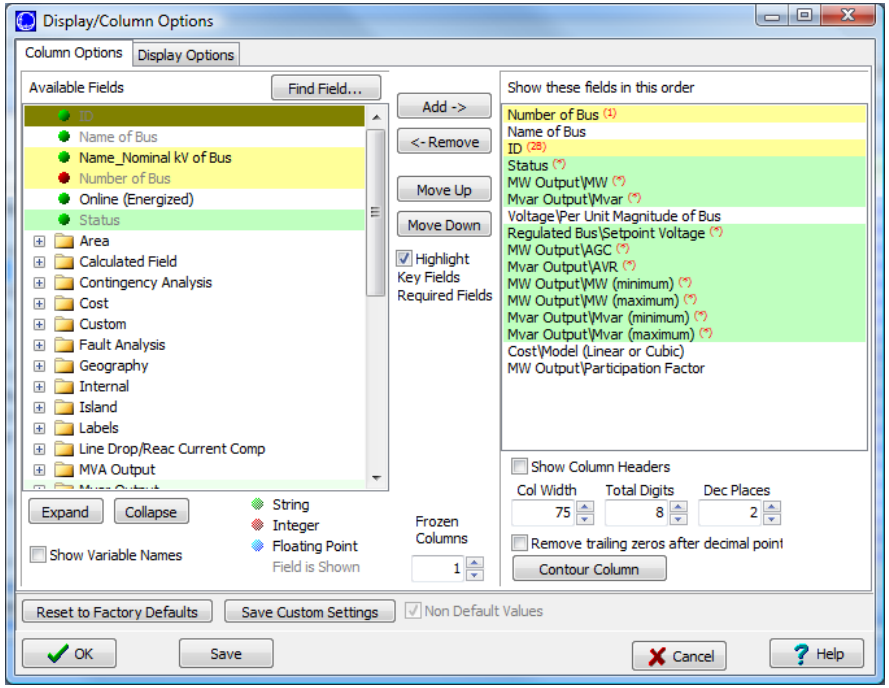
Finding Key and Required Fields in the Simulator Interface

- Key Fields are yellow, Required Fields are Green

	Number of Bus	Name of Bus	ID	Status	Gen MW	Gen Mvar	PU Volt of Bus	Set Volt	AGC	AVR	Min MW
1	30	CONE G1	H	Closed	445.00	226.73	1.050	1.05000	YES	YES	262.(
2	30	CONE G1	L	Closed	405.00	205.60	1.050	1.05000	YES	YES	238.(
3	31	CONE G2	H	Closed	445.00	-21.00	0.970	0.96671	YES	YES	262.(
4	31	CONE G2	L	Closed	405.00	-19.00	0.970	0.96671	YES	YES	238.(
5	32	KEYS G1	H	Closed	433.00	5.00	0.959	0.95862	YES	YES	262.(

- Or in the Display/Column Options Dialog



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ONLY For Legacy Auxiliary File Header DATA Sections

- Start with the word DATA
- An optional data name may follow
  - For use with the LoadData Action
- Following this is a list of parameters enclosed in parenthesis
  - **(object_type,[list_of_fields],file_type_specifier,create_if_not_found)**
    - **object_type**
    - **[list_of_fields]**
    - **file_type_specifier**
    - **create_if_not_found**

```
DataName1(object_type, [list_of_fields], file_type_specifier, create_if_not_found)
{
data_list_1
   :
data_list_n
}
```


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ONLY For Legacy DATA Section file_type_specifier Parameter

- Simulator presently accepts two values
  - none specified
    - Fields which follow are space-delimited
  - CSV
    - Fields which follow are comma-separated

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ONLY For Legacy DATA Section create_if_not_found Parameter

- Optional field
- Specifies whether or not to create a new object if an existing one is not found
  - YES to create object
  - NO to deny creation
  - If omitted, user is prompted
  - If using the LoadAux script command, create_if_not_found will override the CreateIfNotFound script parameter

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DATA Section
Data List

- Following the argument list describing the DATA section, the Data List is given
- Starts with a left curly brace {
- Ends with a right curly brace }
  - Right curly brace must appear on its own line of text
- Between the curly braces, any number of data lists can be entered
  - Each data list represents a single object in Simulator

```
object_type DataName1(list_of_fields)
{
data_list_1
   :
data_list_n
}
```


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DATA Section
Data List

- Specifications of a data list
  - May take up several lines of text
    - Simulator will read the number of fields specified in list_of_fields
    - Each new data object must start on its own line of text
  - You may use the Simulator comment string //
    - Simulator will ignore all text to the right of the double slash
  - Blank lines, or lines which begin with the comment string will be ignored
  - Remember that the right curly brace must appear on its own line at the end of the data_list
  - Fields separated by space or comma depending on file_type_specifier
  - Strings can be enclosed in double quotes, but this is not required
    - You should however always enclose strings that contain spaces (or commas) in quotes. Otherwise, strings containing commas would cause errors for comma-delimited files, and spaces would cause errors for space-delimited formatted files.

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Example DATA Section

object_type

list_of_fields: Note enclosed in brackets [ ]

The two optional arguments are not present

```
BRANCH (BusNumFrom,BusNameFrom,BusNumTo,BusNameTo,Circuit,Status,IsXF,R,X,B, // comment
        // comments can appear here
        LimitMVAA,LimitMVAB,LimitMVAC)
{
//--comments can appear here-----------------------------------------------------------------------------
// Num  Name      ToNum  ToName     CKT   Status  Xfmr?     R          X          B        Alimit    Blimit    Climit
//-------------------------------------------------------------------------------------------------------------
    1 "ROANSPRA"   964 "GIBCRK C" " 1" "Closed" "No"   0.00690   0.03980   0.01080     236.0     236.0     236.0
    1 "ROANSPRA"     4  IOLA      " 1" "Closed" "No"   0.00828   0.04776   0.01296     236.0     236.0     236.0
    5 "IOLA    "     4 "IOLA    " " 1" "Closed" "Yes"  0.00763   0.14166   0.00000      60.0      60.0      60.0
    5 "IOLA    "    13 "KEITH   " " 1" "Closed" "No"   0.13735   0.12184   0.00175      24.0      24.0      24.0
    5 "IOLA    "     9 "BEDIAS  " " 1" "Closed" "No"   0.01980   0.11477   0.00194     118.0     118.0     118.0
    9 "BEDIAS  "    25 "NTHZULCH" " 1" "Closed" "No"   0.03173   0.18395   0.00312      88.0     118.0     118.0
   13 "KEITH   "    17 "CARLOSSW" " 1" "Closed" "No"   0.08233   0.07303   0.00105      24.0      24.0      24.0
   17 "CARLOSSW"    29 "BOONVIL " " 1" "Closed" "No"   0.21753   0.19295   0.00277      24.0      24.0      24.0
   17 "CARLOSSW"    21 "CARLOS  " " 1" "Closed" "No"
      // data can appear on more than one line.  It just read a field for each entry in the list_of fields
                                  0.06540   0.10810   0.00160      35.0      35.0      35.0
   25 "NTHZULCH"    48 "HLTOPLKS" " 1" "Closed" "No"   0.04232   0.24532   0.00416      88.0     118.0     118.0
//-------------------------------------------------------------------------------------------------------------
}
```

Note: "GIBCRK C" needs double quotes because it has a space in the name
IOLA may optionally have quotes

Start and End Data Lists

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DATA Section
SubData

- For some object_types, the DATA section does not provide an adequate method of defining information.
- For these special instances, SUBDATA sections are optionally added to each data list.

```
object_type (list_of_fields)
{
value_list_1
    <SUBDATA subobject_type1>
      precise format describing an object_type1
      precise format describing an object_type1
      :
    </SUBDATA>
    <SUBDATA subobject_type2>
      precise format describing an object_type2
      precise format describing an object_type2
      :
    </SUBDATA>
value_list_2
    :
value_list_n
}
```


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DATA Section
SubData

- Starts with tag `<SUBDATA subobject_type>`
- Ends with tag `</SUBDATA>`
- Inside the tags, you must follow specified format for the respective subobject_type.
  - Values must appear in a precisely defined order
  - A list of the subdata sections for each kind of object_type follow
  - For detailed description of the precisely defined format for each subdata section, see the online help

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SubData Sections allowed for each kind of object_type

- Contingency
  - CTGElement, LimitViol, and Sim_Solution_Options
- CTG_Options
  - Sim_Solution_Options
- Filter
  - Condition
- Gen
  - BidCurve and ReactiveCapability
- Load
  - BidCurve
- MultiSectionLine
  - Bus

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SubData Sections allowed for each kind of object_type

- InjectionGroup
  - PartPoint
- Interface
  - InterfaceElement
- ModelCondition
  - Condition
- ModelFilter
  - ModelCondition
- Owner
  - Bus, Load, Gen, Branch

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SubData Sections allowed for each kind of object_type

- DataGrid
  - ColumnInfo
- ATCScenario
  - TransferLimiter, ATCExtraMonitor
- … and many more

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Example DATA Section with SubData

normal Data List

```
CONTINGENCY (Name,Skip,Processed,Solved)
{
"Contingency Name" "NO" "NO" "NO"
  <SUBDATA CTGElement>
    // just some comments
    // action                      Model Criteria  Status   comment
    "BRANCH 40821 40869 1  OPEN" ""               ALWAYS //Raver - Paul 500 kV
    "GEN 45041 1  OPEN"          ""               ALWAYS //Trip Unit #2
    "BRANCH 42702 42727 1  OPEN" "Line X Limited" CHECK  //Open Fern Hill
    "GEN 40221 1  OPEN"          "Interface L1"   CHECK  //Drop ~600 MW
    "GEN 40227 1  OPEN"          "Interface L2"   CHECK  //Drop ~1200 MW
    "GEN 40221 1  OPEN"          "Interface L3"   CHECK  //Drop ~600 MW
    "GEN 40227 1  OPEN"          "Interface L3+"  CHECK  //Drop ~1200 MW
  </SUBDATA>

"Contingency Name 2" "NO" "NO" "NO"
  <SUBDATA CTGElement>
    // just some comments
    // action                      Model Criteria  Status   comment
    "BRANCH 40821 40869 1  OPEN" ""               ALWAYS //Raver - Paul 500 kV
  </SUBDATA>
}
```

subobject_type

Specific Format for CTGElement

SUBDATA, /SUBDATA tags

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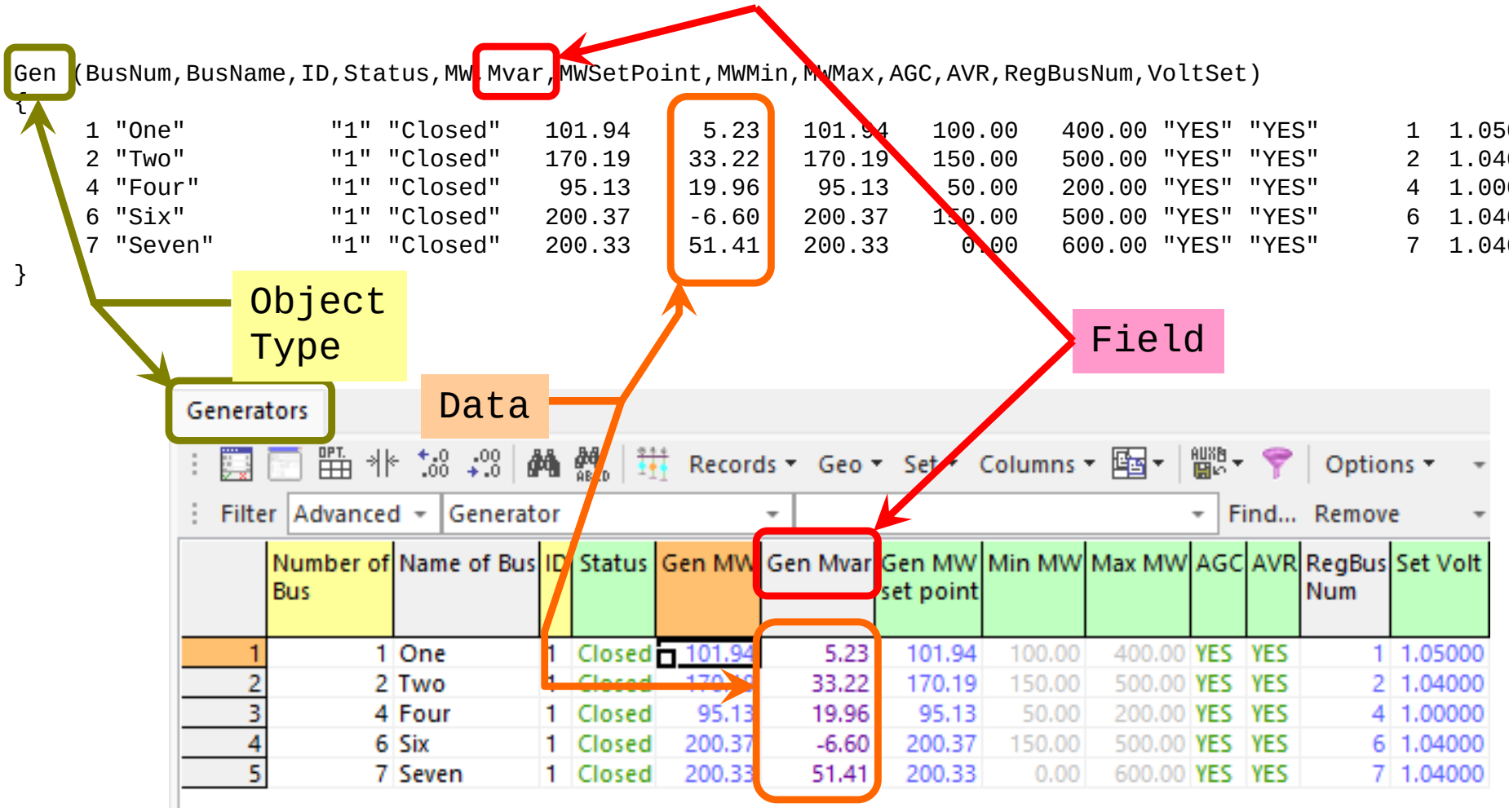
Correlation of Case Info Display to an Auxiliary DATA Section



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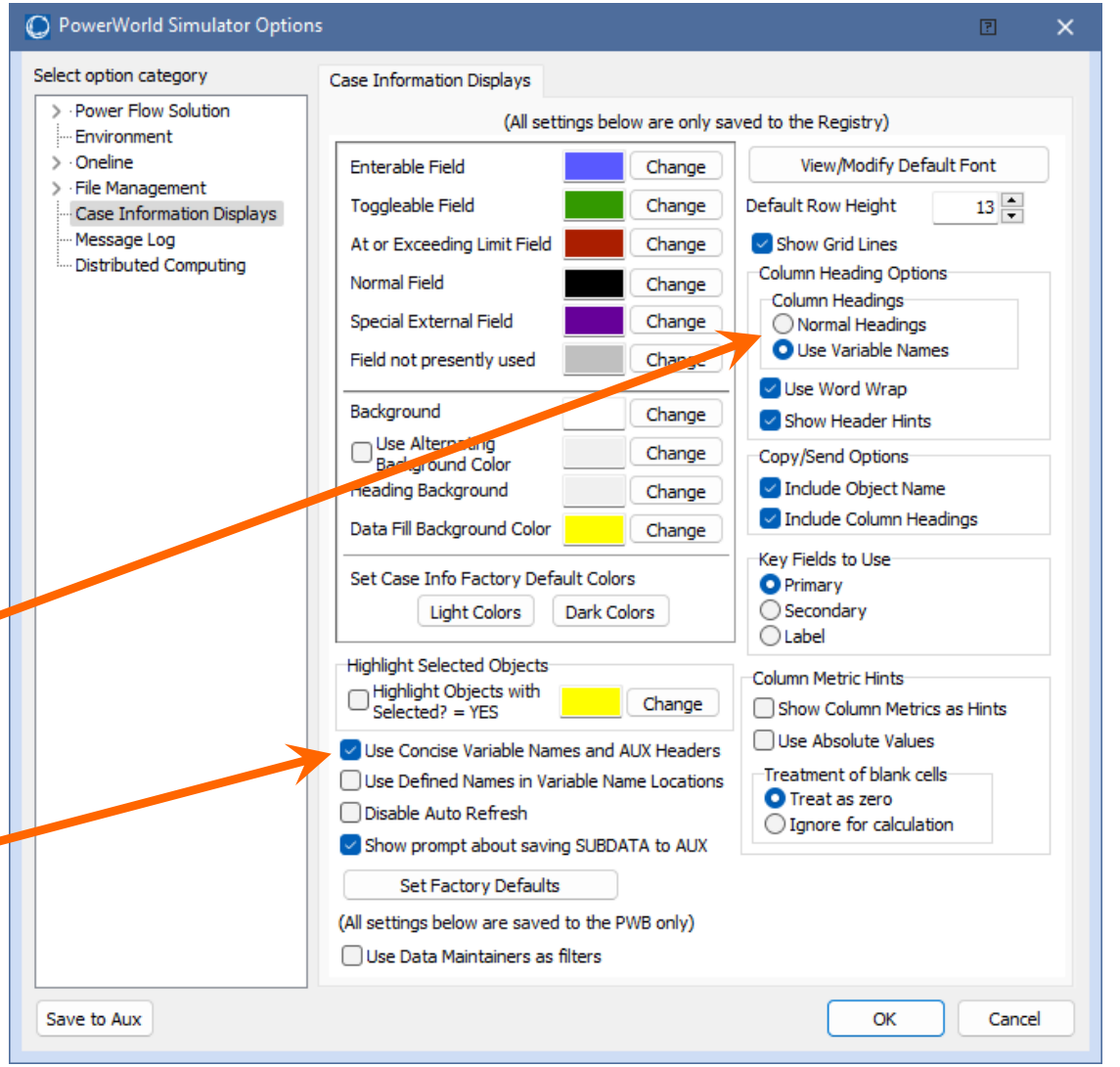
Option For changing Case Info Display Column Heading to Variables

- Choose **Options → Simulator Options**
  - Then go to the Case Information Displays option category
  - Change the **Column Headings** to *Use Variable Names*

Use *Normal Headings* or *Variable Names*

Use *Concise Variable Names and AUX Headers*



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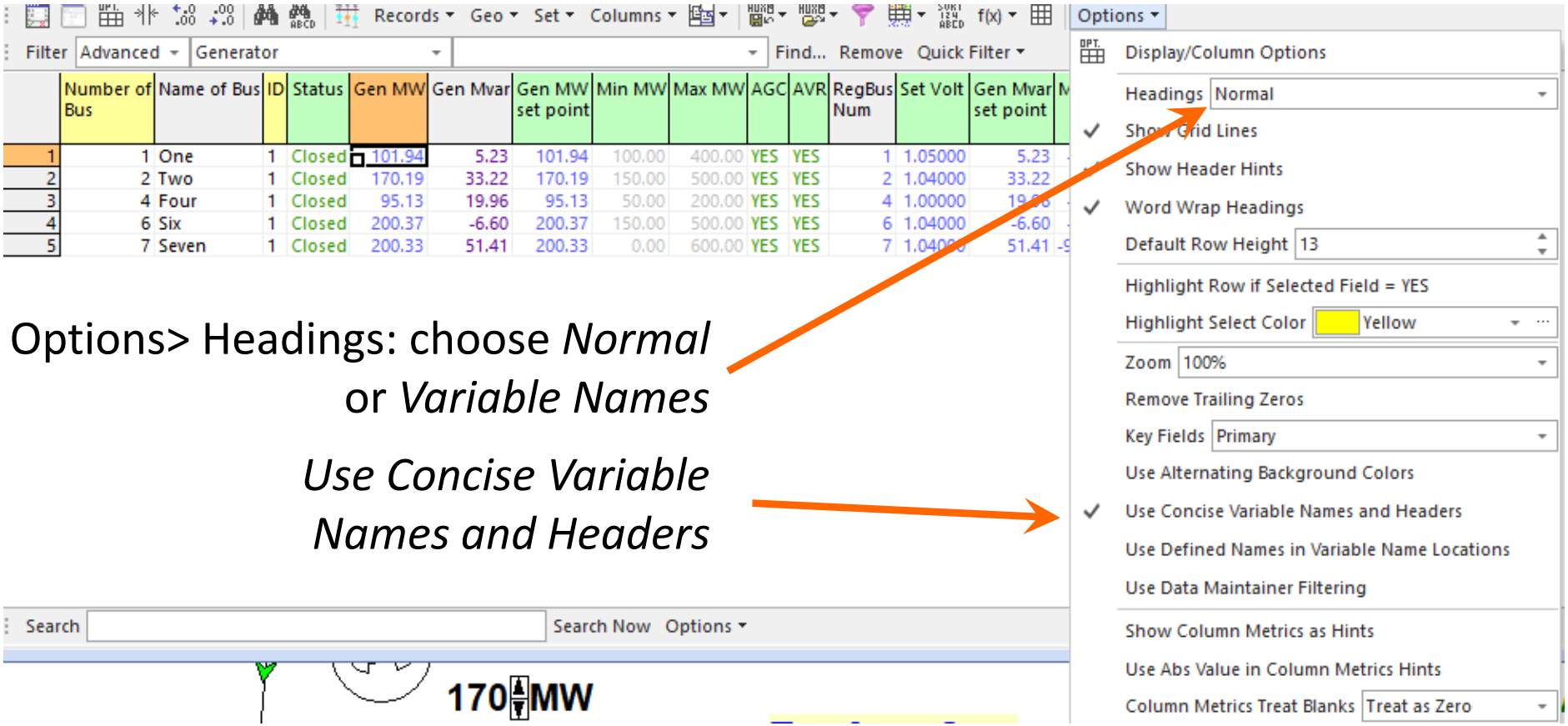
Option For changing Case Info Display Column Heading to Variables

- You can also change the option in the toolbar



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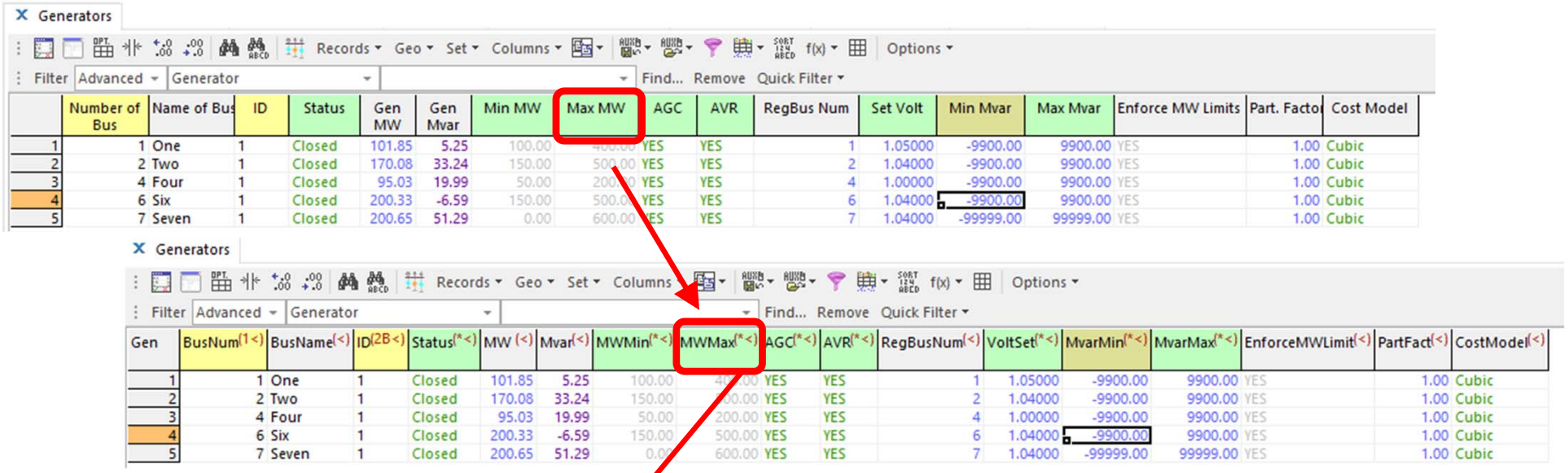
Use Variable Names

- Provides a graphical way for you to see the variable names




```
Gen (BusNum,BusName,ID,Status,MW,Mvar,MWMin,MWMax,AGC,AVR,RegBusNum,VoltSet,MvarMin,MvarMax,EnforceMWLimit,PartFact,CostModel)
{
     1 "One"   "1" "Closed"   101.85     5.25   100.00   400.00 "YES" "YES"    1  1.05000 -9900.00  9900.00 "YES"    1.00 "Cubic"
     2 "Two"   "1" "Closed"   170.08    33.24   150.00   500.00 "YES" "YES"    2  1.04000 -9900.00  9900.00 "YES"    1.00 "Cubic"
     4 "Four"  "1" "Closed"    95.03    19.99    50.00   200.00 "YES" "YES"    4  1.00000 -9900.00  9900.00 "YES"    1.00 "Cubic"
     6 "Six"   "1" "Closed"   200.33    -6.59   150.00   500.00 "YES" "YES"    6  1.04000 -9900.00  9900.00 "YES"    1.00 "Cubic"
     7 "Seven" "1" "Closed"   200.65    51.29     0.00   600.00 "YES" "YES"    7  1.04000 -99999.00 99999.00 "YES"   1.00 "Cubic"
}
```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Display Auxiliary Files

- One-line diagram objects can also be saved and edited in the auxiliary file format (*.axd file extension).
- Case Information Displays for one-line diagrams are accessed from **Onelines → List Display → All Display Objects…**
- Save entire one-line in axd format
  - **File → Save Oneline As…**
  - Choose *Display Auxiliary File (*.axd)* from **Save as type:**
- Open entire one-line in axd format
  - **File → Open Oneline…**
  - Choose *Display Auxiliary File* from **Files of type:**
- **Auxiliary ID** (*SOAuxiliaryID*) field used as an extra key field to uniquely identify objects

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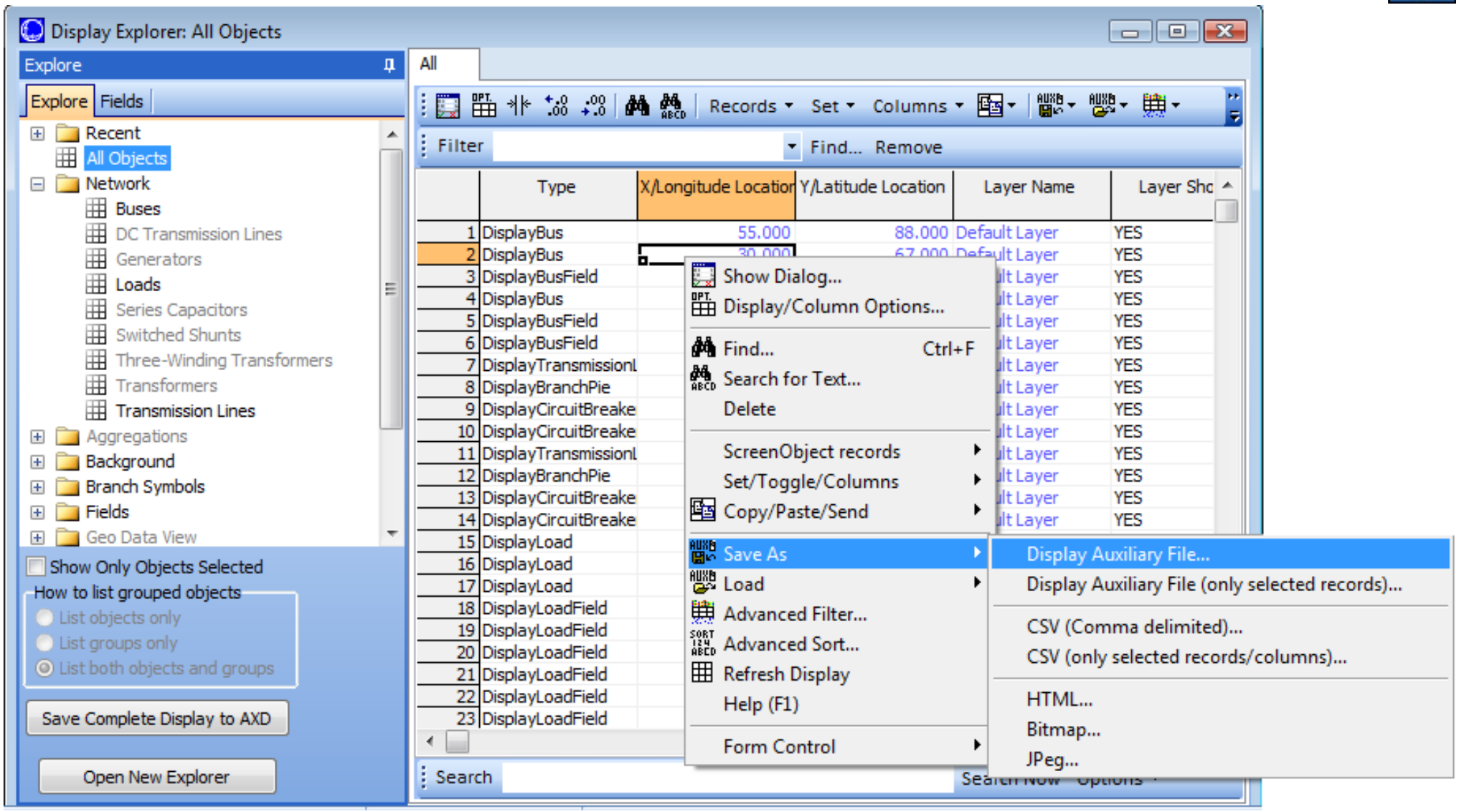
Display Objects



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Example Display Auxiliary DATA Section

Object Type for this example is DisplayBus

```
DISPLAYBUS (BusNum,SOAuxiliaryID,SOX,SOY,SOThickness,SOColor,SOUseFillColor,SOFillColor,
   SOSize,SOWidth,SOOrientation,SOLevel,SOSameLevelDisplayPriority,SOImmobile,
   SLName,SOStyle,SODashed,SOBelongsToGroup)
{
      1 "1"  9.00000000 63.00000000       1 0 "YES"       0    6.00    0.45 "Right" "Middle" 132 "NO "
"Default Layer" "Rectangle"       0 ""
      2 "1" 19.00000000 42.00000000       1 0 "YES"       0   11.00    0.45 "Right" "Middle" 131 "NO "
"Default Layer" "Rectangle"       0 ""
      3 "1" 37.00000000 63.00000000       1 0 "YES"       0    5.00    0.45 "Right" "Middle" 130 "NO "
"Default Layer" "Rectangle"       0 ""
      4 "1" 72.00000000 57.00000000       1 0 "YES"       0    9.00    0.45 "Right" "Middle" 129 "NO "
"Default Layer" "Rectangle"       0 ""
      5 "1" 68.00000000 36.00000000       1 0 "YES"       0    6.00    0.45 "Right" "Middle" 128 "NO "
"Default Layer" "Rectangle"       0 ""
      6 "1" 15.00000000 15.75000000       1 0 "YES"       0    8.00    0.45 "Right" "Middle" 121 "NO "
"Default Layer" "Rectangle"       0 ""
      7 "1" 54.00000000 15.75000000       1 0 "YES"       0   11.00    0.45 "Right" "Middle" 119 "NO "
"Default Layer" "Rectangle"       0 ""
}
```


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Display Auxiliary File Example

- Case *ACTIVSg10kOPF.raw*
- *I04_Auxiliary File Data Section\WABus.axd*: adds state background and several 345 kV buses and transmission lines
- Load axd into new or existing one-line diagram

```
DisplayTransmissionLine
(BusNum,BusNum:1,LineCircuit,SOAuxiliaryID, …)
{
 10586   10588 " 1" "1" …
   <SUBDATA Line>
 // Coordinates are Mercator
   [-119.28191216 47.19970512] [-119.28011216 47.19970512]
   [-119.28011216 47.19970512] [-119.27111216 47.19970512]
</SUBDATA>
…
}
```


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Case Information Ribbon Tab:
Auxiliary File Export Format Descriptions

- Allows you to define a list of DATA sections you would like to write out to an Auxiliary File
  - Object Type: Specify type of object
  - Filter Name: All, Selected, AreaZone, or the name of an Advanced Filter in quotes. 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
- You can then use a script command to invoke saving all this information
  - SaveDataUsingExportFormat("filename", filetype, "FormatName");

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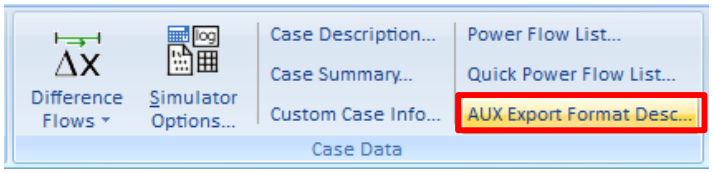
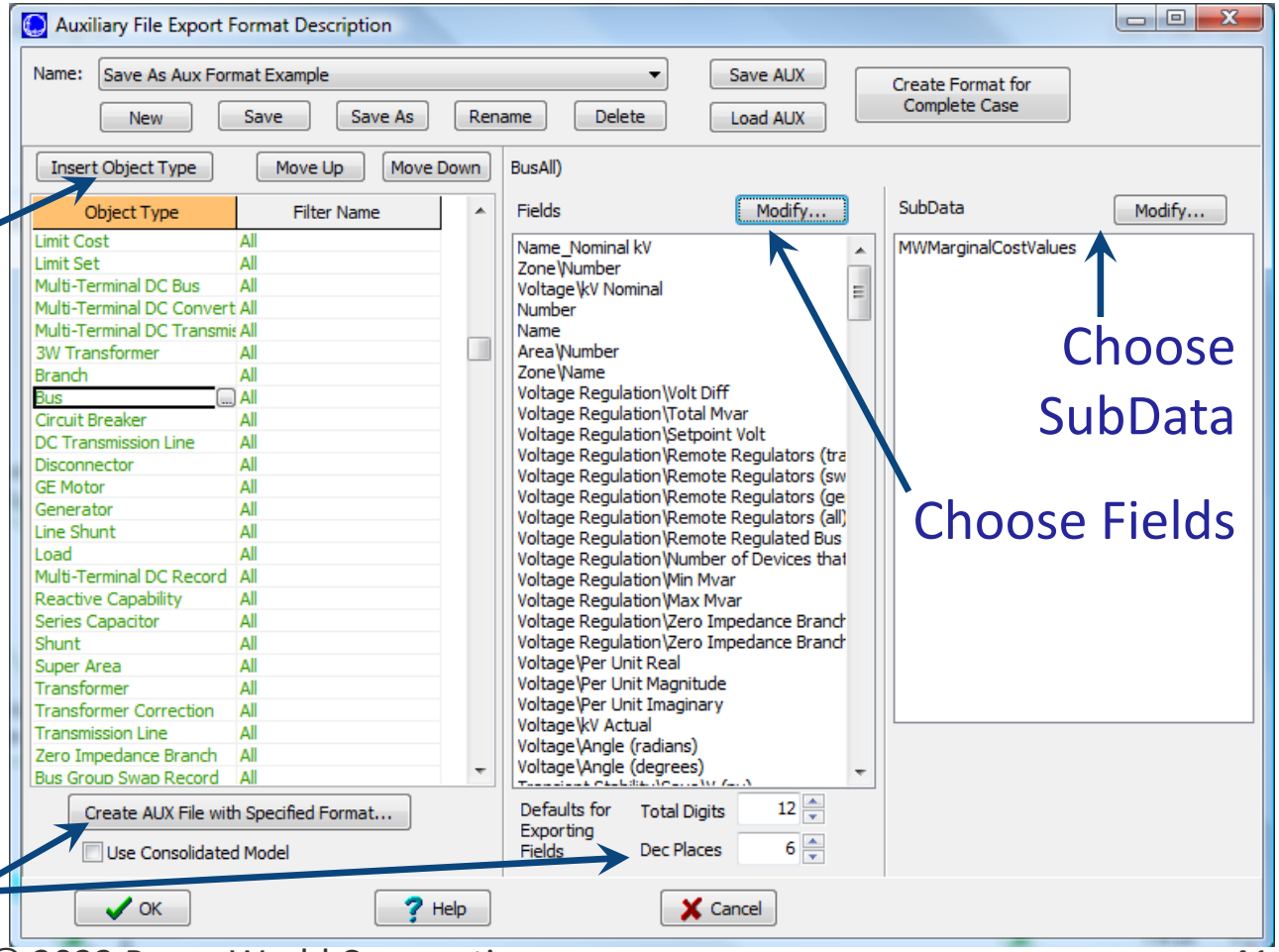
Case Information Ribbon Tab:
Auxiliary File Export Format Descriptions Dialog

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





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Special Object Types to Provide Better Access to SUBDATA Objects

- Previously, several types of data were only accessible through SUBDATA sections of AUX Files
- This limited your ability to systematically edit/query these objects
  - Could not use Copy/Paste To/From a Spreadsheet
  - Could not use SimAuto commands to access
  - Could not use Script Commands (SaveData, SetData)
- Most of these limitations have now been removed for most object types
  - New object types have been created that provide access to this data in “sub-tables”
    - [in “database speak” = this is table with a foreign key constraint]

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Special Object Types Created to Provide Access to SUBDATA

New Object Type Created	Existing Object Type this SUBDATA is related to	Existing SUBDATA Section <SUBDATA XXX>
ReactiveCapability	Gen	ReactiveCapability
PartPoint	InjectionGroup	PartPoint
InterfaceElement	Interface	InterfaceElement
MTDCBus	MTDCRecord	MTDCBus
MTDCConverter	MTDCRecord	MTDCConverter
MTDCTransmissionLine	MTDCRecord	MTDCTransmissionLine
ContingencyElement	Contingency	CTGElement
ViolationCTG	Contingency	LimitViol
CTGElementBlockElement	CTGElementBlock	CTGElement
GlobalContingencyActionsElement	GlobalContingencyActions	CTGElement
PostPowerFlowActionsElement	PostPowerFlowActions	CTGElement

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Interface / Interface Element In Auxiliary Files

Interface Objects with <SUBDATA InterfaceElement>

```
INTERFACE (Number, Name, MonDirection,
           LimitMWA, LimitMWB, LimitMWC)
{
1 "East Side" "FROM -> TO" 0.0 0.0 0.0
   <SUBDATA InterfaceElement>
     "BRANCH 4 2 1" NO  0.500000
     "BRANCH 4 3 1" NO  0.600000
     "BRANCH 4 5 1" NO  0.700000
   </SUBDATA>
2 "West Side" "FROM -> TO" 0.0 0.0 0.0
   <SUBDATA InterfaceElement>
     "BRANCH 2 5 1" NO  0.800000
     "BRANCH 2 4 1" NO  0.900000
   </SUBDATA>
}
```

Interface Objects and InterfaceElement Objects

```
INTERFACE (Number, Name, MonDirection,
          LimitMWA, LimitMWB, LimitMWC)
{
1 "East Side" "FROM -> TO" 0.0 0.0 0.0
2 "West Side" "FROM -> TO" 0.0 0.0 0.0
}
INTERFACEELEMENT (InterfaceName, Element,
                  MeterFar, Weight)
{
"East Side"  "BRANCH 4 2 1"  "NO"  0.50
"East Side"  "BRANCH 4 3 1"  "NO"  0.60
"East Side"  "BRANCH 4 5 1"  "NO"  0.70
"West Side"  "BRANCH 2 5 1"  "NO"  0.80
"West Side"  "BRANCH 2 4 1"  "NO"  0.90
}
```

These Auxiliary Files represent EXACTLY the same data

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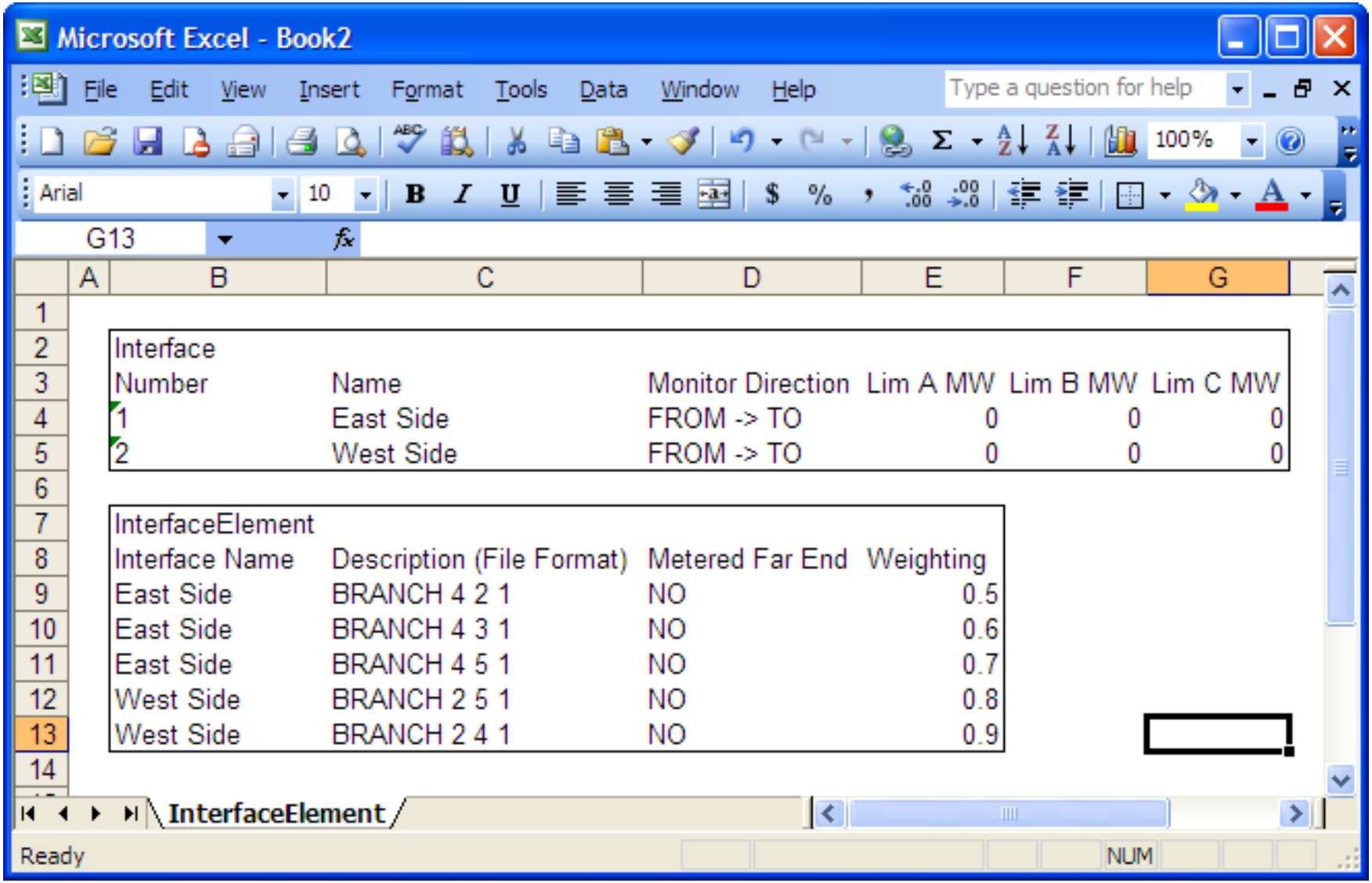
Interface / Interface Element In an Excel Spreadsheet



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Injection Group / PartPoint In Auxiliary Files

Injection Group Objects with <SUBDATA PartPoint>

```
INJECTIONGROUP (Name)
{
"Big Gens"
   <SUBDATA PartPoint>
     "GEN" 1 "1"  1.0000 "SPECIFIED" "YES"
     "GEN" 2 "1"  1.0000 "SPECIFIED" "YES"
     "GEN" 4 "1"  1.0000 "SPECIFIED" "YES"
   </SUBDATA>
"Little Gens"
   <SUBDATA PartPoint>
     "GEN" 6 "1"  1.0000 "SPECIFIED" "YES"
     "GEN" 7 "1"  1.0000 "SPECIFIED" "YES"
   </SUBDATA>
}
```

Injection Group Objects and PartPoint Objects

```
INJECTIONGROUP (Name)
{
"Big Gens"
"Little Gens"
}

PARTPOINT (GroupName, Object, AutoCalcMethod,
           PartFact, AutoCalc)
{
"Big Gens"    "GEN 1 1" "SPECIFIED" 1.00 "YES"
"Big Gens"    "GEN 2 1" "SPECIFIED" 1.00 "YES"
"Big Gens"    "GEN 4 1" "SPECIFIED" 1.00 "YES"
"Little Gens" "GEN 6 1" "SPECIFIED" 1.00 "YES"
"Little Gens" "GEN 7 1" "SPECIFIED" 1.00 "YES"
}
```

These Auxiliary Files represent EXACTLY the same data

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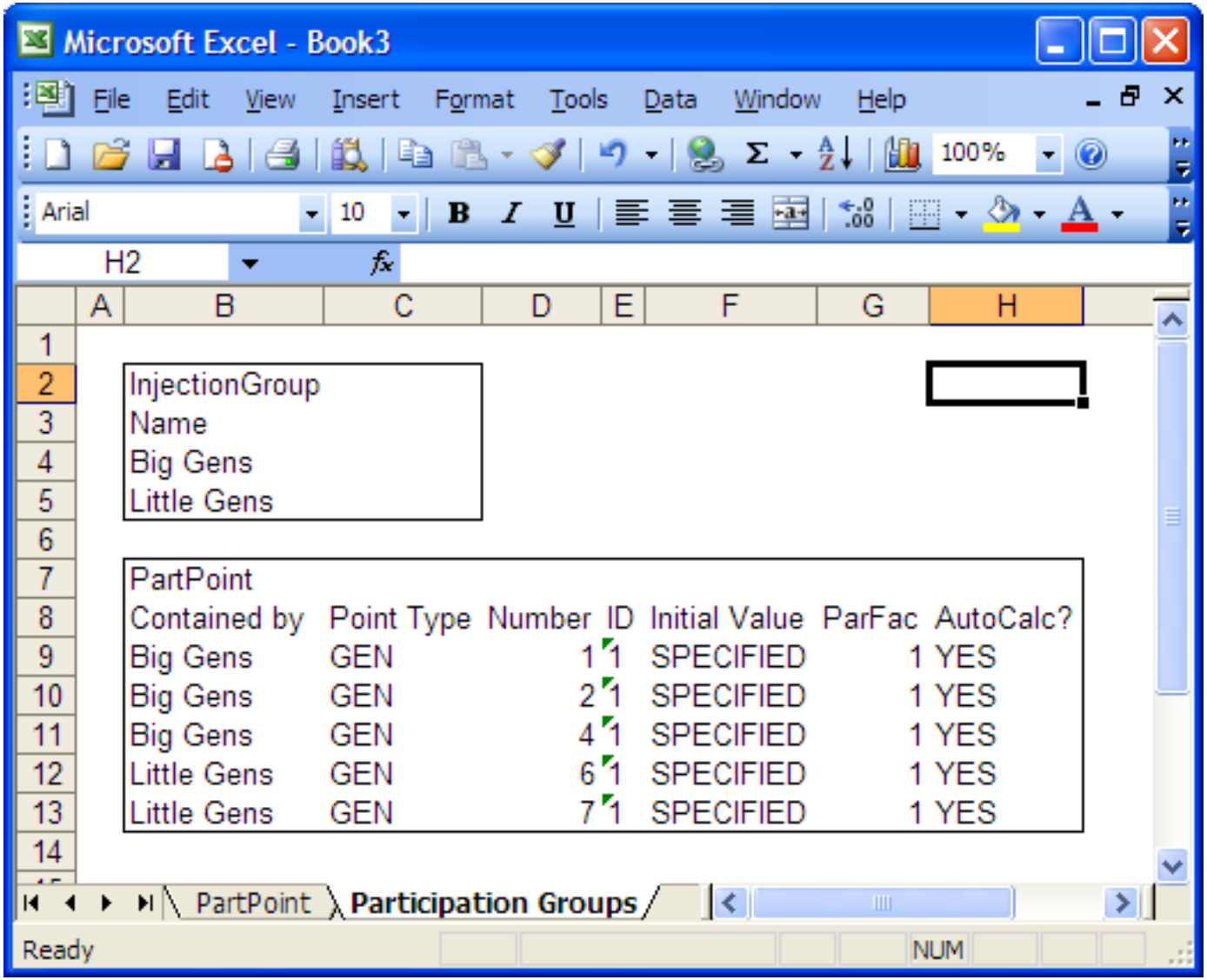
Injection Group / PartPoint In an Excel Spreadsheet



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Contingency / ContingencyElement In Auxiliary Files

Contingency Objects with <SUBDATA CTGElement>

```
CONTINGENCY (Name)
{
"West Outage"
   <SUBDATA CTGElement>
     "BRANCH 2 5 1  OPEN" "" CHECK
     "BRANCH 2 4 1  OPEN" "" CHECK
   </SUBDATA>
"East Outage"
   <SUBDATA CTGElement>
     "GEN 2 MOVE_P_TO 4 50 PERCENT" "" CHECK
     "BRANCH 2 5 1  OPEN" "" CHECK
     "BRANCH 4 5 1  OPEN" "" CHECK
</SUBDATA>}
```

Contingency Objects and Contingency Element Objects

```
CONTINGENCY (Name)
{
"West Outage"
"East Outage"
}

CONTINGENCYELEMENT (Name, Object, Action,
                    Criteria, CriteriaStatus)
{
"East Outage" "GEN 2" " MOVE_P_TO 4 50 PERCENT" "" "CHECK"
"East Outage" "BRANCH 2 5 1" "OPEN" "" "CHECK"
"East Outage" "BRANCH 4 5 1" "OPEN" "" "CHECK"
"West Outage" "BRANCH 2 4 1" "OPEN" "" "CHECK"
"West Outage" "BRANCH 2 5 1" "OPEN" "" "CHECK"
}
```

These Auxiliary Files represent EXACTLY the same data

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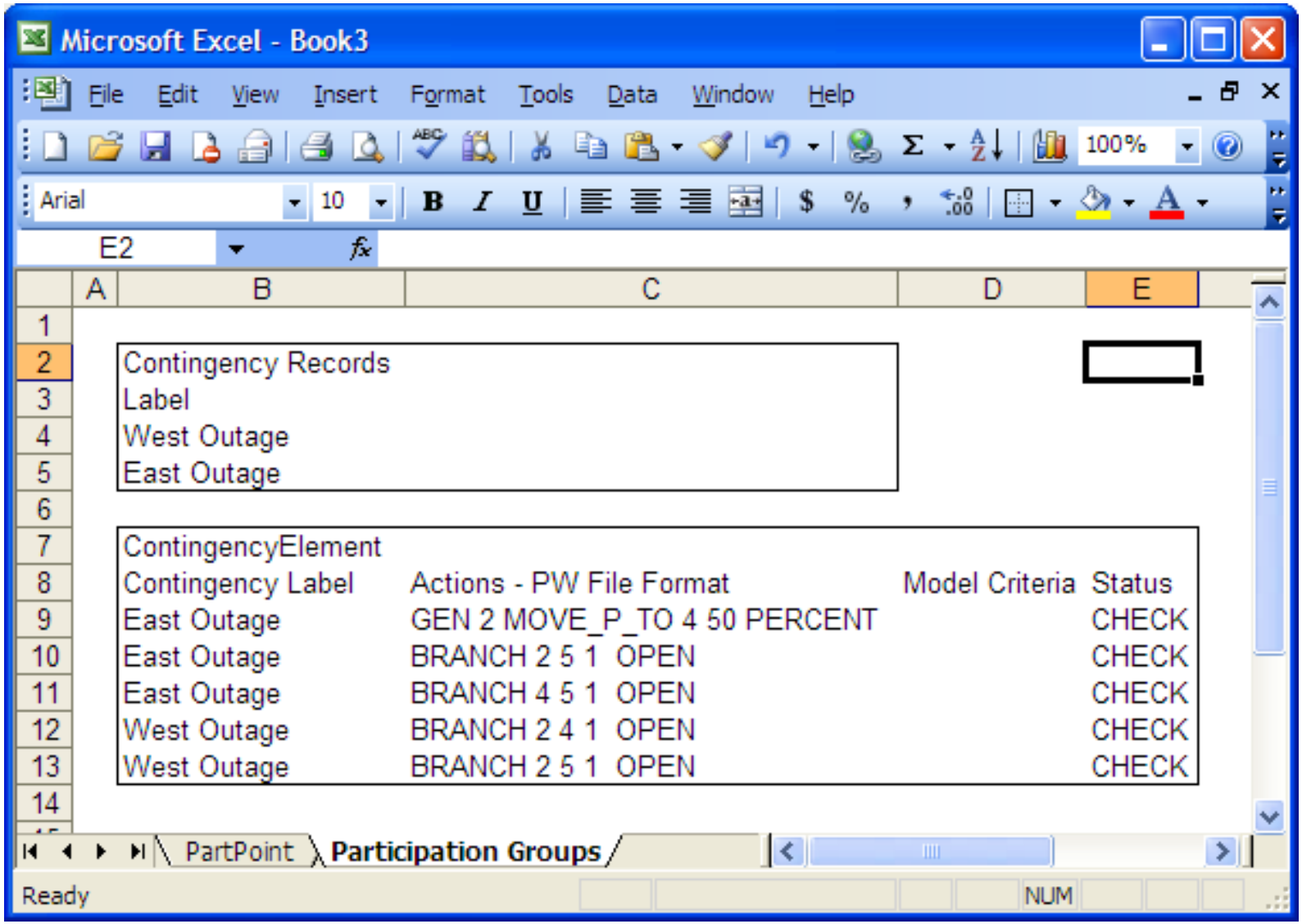
Contingency / ContingencyElement In an Excel Spreadsheet



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Special Support Sub-Types of Special Object Types

- These special object types give you access to a combination of all the “sub-object” fields and specific device fields simultaneously

New Object Type	PartPoint	InterfaceElement
Special Sub-Types which provide access to two tables simultaneously	PartPointGen PartPointInjectionGroup PartPointLoad PartPointShunt	InterfaceElementBranch InterfaceElementBranchClose InterfaceElementBranchOpen InterfaceElementDCLine InterfaceElementGen InterfaceElementInjectionGroup InterfaceElementInterface InterfaceElementLoad InterfaceElementMSLine

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Example: Special Support Sub-Types of Special Object Types

- PartPointGen
  - Provides access to all PartPoints that represent generator objects
  - Provides access to BOTH the list of fields for the PartPoint AND the Gen
- InterfaceElementBranch
  - Provides access to all InterfaceElements that represent branch objects
  - Provides access to BOTH the list of fields for the InterfaceElement AND the Branch

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Special Fields Provide Access to SUBDATA

- ATCScenario object with <SUBDATA TransferLimiter>
  - Instead of creating new object type, extra key fields are added to existing TransferLimiter object type
    - ATCLineZoneChanges, ATCGenChanges, ATCInterfaceChanges
  - When fields are present, records are associated with the ATC scenario identified by the extra key fields
  - When fields are not present, records are associated with the standard single set of ATC results

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