Limit Monitoring Settings

• Many tools in Simulator use power system limits of some type
  – Contingency analysis
  – Available Transfer Capability (ATC)
  – Optimal Power Flow (OPF)
  – Security Constrained Optimal Power Flow (SCOPF)
  – PV and QV Curve Tool (PVQV)

• Limits for power system elements include
  – MVA or Amp limits on transmission lines and transformers
  – MW limits on interfaces
  – High and low voltage limits for buses
Limit Monitoring Settings

• By DEFAULT, ALL elements in the power system are monitored
• Use Limit Monitoring Settings to
  – Exclude elements in the power system that are of no interest for a particular study
  – Specify which limits should be monitored, or in the case of the OPF and SCOPF, which limits should be enforced
  – Specify which limit sets should be used for a particular study and how these limit sets should be applied
• Limit Monitoring Settings will be used extensively with the tools discussed in the remainder of the training
Limit Monitoring Settings

- Define settings for monitoring limits by selecting the Tools ribbon tab Limit Monitoring Settings.
- Create or modify Limit Groups and assign devices to different Limit Groups.
- Different Line, Interface and Voltage limits can be assigned to each Limit Group, and each device within a Limit Group will adhere to its own Limit Group Settings.
Limit Monitoring Settings

• In general, keep in mind that a bus, transmission line/transformer, or interface’s limit is monitored only if the following conditions are met.
  – Its Monitor field is set to YES
  – Its Limit Group is Enabled
  – Its Area is set to Report Limits and it meets the kV range for reporting
  – Its Zone is set to Report Limits and it meets the kV range for reporting
Limit Monitoring Dialog
Tabs

• Area/Zone Reporting
  – You can specify which areas/zones to monitor and what kV ranges to monitor in these areas/zones

• Buses, Lines, Interfaces, and Nomograms show the individual elements of the power system
  – Important columns are
    • Monitor: specifies whether to monitor that specific element
    • Limit Group: specifies the Limit Group that the element belongs to

• Modify/Create Limit Groups
  – Use to create and modify Limit Groups.
  – By default all elements are in a limit group named Default
Limit Monitoring Dialog: Area/Zone Reporting Tab

Areas and Zones are not assigned to limit groups. However, a power system element is only monitored if ALL of the following are true:
1. Its Monitor field is set to YES
2. Its Limit Group is Enabled
3. Its Area is set to Report Limits and it meets the KV range for reporting
4. Its Zone is set to Report Limits and it meets the KV range for reporting

Because of this, the Area and Zone Lists are provided here for your convenience.

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Report Limits</th>
<th>Report Min kv</th>
<th>Report Max kv</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Top</td>
<td>YES</td>
<td>0.00</td>
<td>9999.00</td>
</tr>
<tr>
<td>2</td>
<td>Left</td>
<td>YES</td>
<td>0.00</td>
<td>9999.00</td>
</tr>
<tr>
<td>3</td>
<td>Right</td>
<td>YES</td>
<td>0.00</td>
<td>9999.00</td>
</tr>
</tbody>
</table>
Limit Monitoring Dialog: Lines Tab
Limit Monitoring Dialog: Limit Groups Tab

Limit Monitoring Settings and Limit Violations

Use the Modify/Create Limit Groups to tab to modify and create limit groups to which Buses, Lines and Interfaces can be assigned.

Use the Buses, Lines and Interfaces tabs to assign elements to different limit groups.

The Areas and Zones tabs are provided here for your convenience.

Save Monitoring Settings
Load Monitoring Settings

Limit Group Values

Limit Group: Default
Group Disabled / Do Not Monitor

Lines & Transformers
Interfaces
Buses

Number Of Violations
Low Voltage Buses: 0
High Voltage Buses: 0
Low-voltage Suspects: 0
Lines/Transformers: 0
Interfaces: 0

Percentage: 100.0
Normal Rating Set: A
Contingency Rating Set: A
Treat Line Limits as Equivalent Amps

Do not monitor radial lines and buses (applied to all limit groups)

Modify/Create Limit Groups

Use this tab to modify/create limit groups to which Buses, Lines, and Interfaces can be assigned.

Limit Group  Branch %  Line Rate Set  Amps or MVA  Interface %  Int. Rate Set  Nomogram %  Low PU Volt  High PU Volt  Ctg Low PU Volt  Ctg High PU Volt  Bus Low Rab
1 Default  100.00 A  Amp/MVA  100.00 A  100.00  0.9000  1.1000  0.9000  1.1000 A

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Limit Monitoring Dialog

- **Elements to Show**
  - Determine which elements should be displayed in the grids contained on the dialog tabs

- **Number of Violations**
  - Summary of how many elements have violations

- **Limit Group Values**
  - **Limit Group**
    - Select the Limit Group name to set options using the Lines & Transformers, Interfaces, and Buses tabs (Top Right)
  - **Group Disabled/Do Not Monitor**
    - Check this box to ignore all power system element limits in the Limit Group.
  - **Do not monitor radial lines and buses (applied to all limit groups)**
    - Check this box to ignore limits caused by radial lines and buses

- **Most Limit Group options can be set in the upper right portion of the dialog, the Modify/Create Limit Groups tab, or the Limit Group Dialog**
Limit Monitoring Dialog: Lines & Transformers Tab (Top Right)

- **Line/Transformer Percentage**
  - The percentage to which Simulator’s study tools will limit a line. Typically this is 100%, but it can be modified.

- **Line/Transformer Normal Rating Set**
  - You may define eight different ratings to transmission lines or transformers. These ratings are called Rating A, B, C, D, E, F, G, and H.
Limit Monitoring Dialog: 
Lines & Transformers Tab (Top Right)

- **Line/Transformer Contingency Rating Set**
  - This field specifies the rating set used for post-contingency monitoring of Lines/Transformers during Contingency Analysis.

- **Treat Line Limits as Equivalent Amps**
  - Limits for transmission lines and transformers are always entered in MVA. However, when reporting limit violations, it is common to check transmission line limits in terms of their amp loading.
  - For reference, the amp rating of a line is derived from the MVA rating using the formula
    \[ AmpRating = \frac{MVARating}{\sqrt{3} \times BaseKV} \times 1000 \]
Limit Monitoring Dialog: Interfaces Tab (Top Right)

- **Interface Percentage**
  - The percentage to which Simulator’s study tools will limit an interface. Typically this is 100%, but it can be modified.

- **Interface Normal Rating Set**
  - You may define eight different ratings to an interface. These ratings are called Rating A, B, C, D, E, F, G, and H.

- **Interface Contingency Rating Set**
  - This field specifies the rating set used for post-contingency monitoring of Interfaces during Contingency Analysis.
Limit Monitoring Dialog:
Buses Tab (Top Right)

• Low Voltage Limit
  – By default, monitored buses will be flagged as violated if they fall below this per unit voltage.

• High Voltage Limit
  – By default, monitored buses will be flagged as violated if they go above this per unit voltage.

• Voltage Rating Sets
  – Determine the rating set to use if buses are using bus specific limits
  – Four different high and low limits, A, B, C, and D, can be defined for each bus
  – **Use Specific Limits** field must be *YES* for a bus to use one of these voltage rating sets
Limit Group Dialog

- Right-click on one of the limit groups and choose Show Dialog to bring up the Limit Group Dialog.

![Limit Group Dialog](image)

Piece-wise Linear Limit Cost function for use with unenforceable constraints in OPF and SCOPF. This will be discussed later in the OPF section.
Limit Group Dialog

- Limiting End
  - Set to Higher or Lower
  - For a transmission branch, the percent loading will normally be slightly different at each end of the branch
  - This setting specifies whether to use the higher of the two values, or the lower.
  - Almost always set to Higher
Radial Elements

- Radial buses are connected to the rest of the system by a single line. A line is considered radial if it is this branch.
  - Often are a “problem” due to bad data
    - Generator output is larger than the step-up transformer’s limit
    - Large load connected to system by line with limit less than the load value
  - Note: in next figure only the last bus and line are radial
    - This is a modeling problem, and you may want to just ignore all these problems globally.
- Check **Do not monitor radial lines and buses** to ignore limit violations
Simulator Tip

- Make extensive use of the Advanced Filtering to help you set up Limit Monitoring Settings
  - Once you apply an advanced filter that limits what you are viewing to only those elements you want to change, you can use Toggle All on the local menu to set the Monitor Field, or the Limit Group Field to the value you are interested in
Showing Limit Violations for the present power system

- Set Elements to Show to Violating Elements to filter the lists of elements to only those that have a violation.
- Select the Buses, Lines, Interfaces, or Nomograms tab to view violated elements of that type.
- Violations are reported only for those devices that the Limit Monitoring Settings are set to monitor.