

UI Design: Ideas, Concepts, Suggestions

Wolfgang Zwick,
National Instruments Germany GmbH

Agenda

1. Design guidelines for GUIs
2. Organization and layout of the screen
3. Scaling for different monitor resolutions
4. User interface design
5. EN ISO 9241

Terms

UI: User Interface

- How user interacts with the program
- First thing the user notices

“UX”: User Experience

- Sometimes used interchangeably with UI
- Broader, covers workflow

Design Guidelines

The Four Ws:

Where am I?

Which path got me here?

What can I do here?

Where To? How can I navigate?

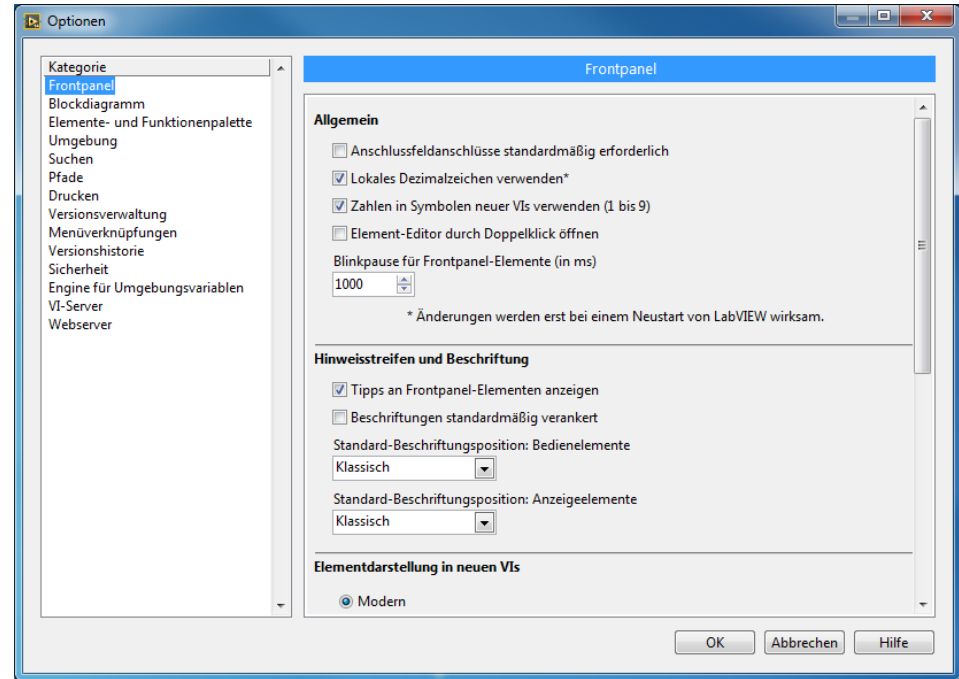
Design Rules

Simplicity

Regularity

Symmetry

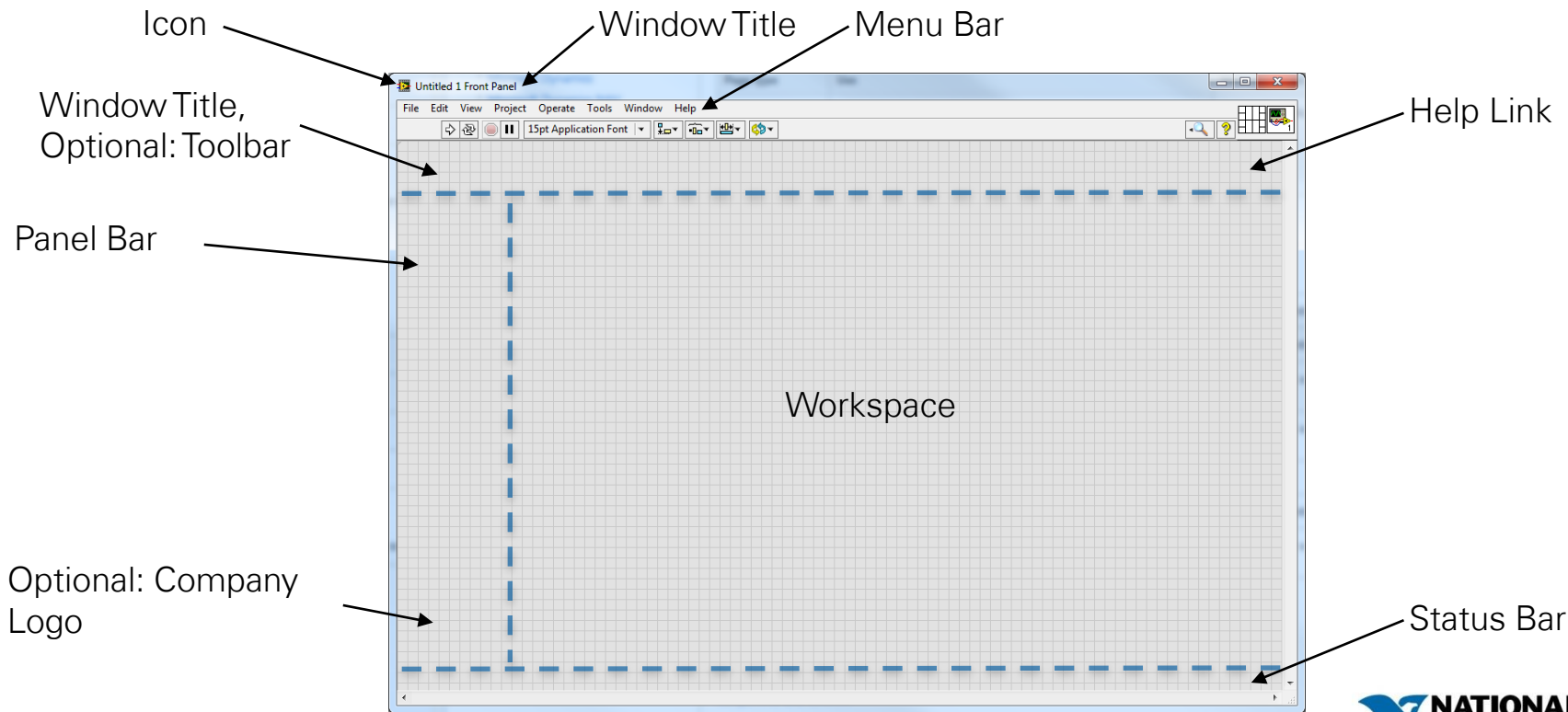
Inner balance



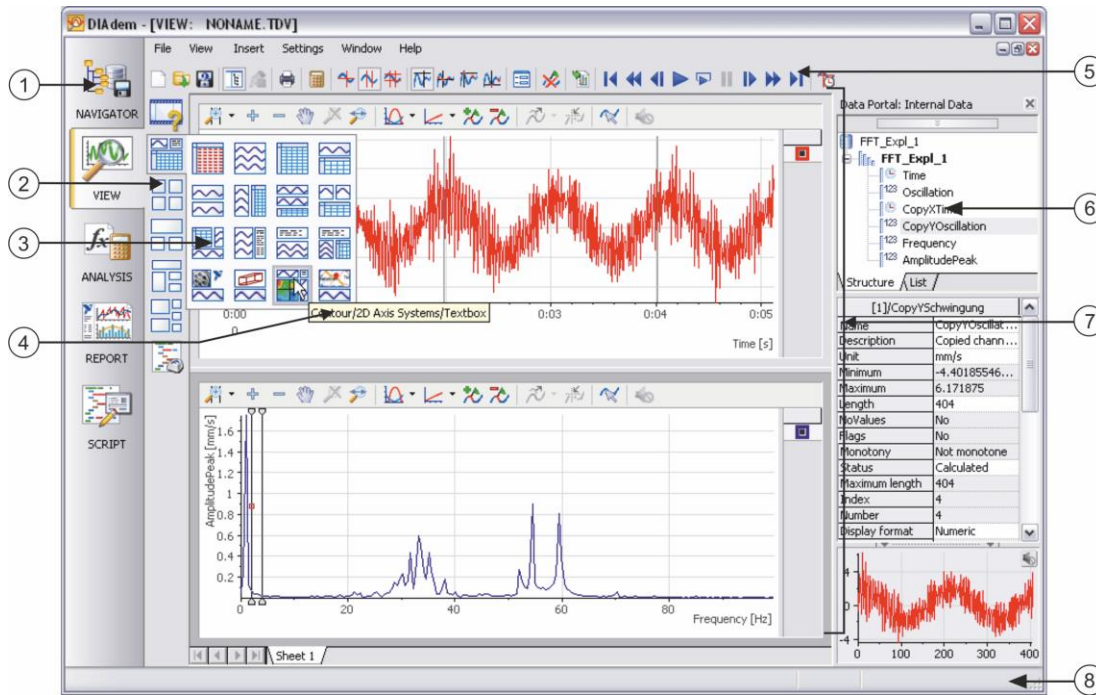
Contextual relationships should be displayed visually as a unit.

Organizing Your Screen

Typical Screen Layout



Screen Layout: DIAdem Example

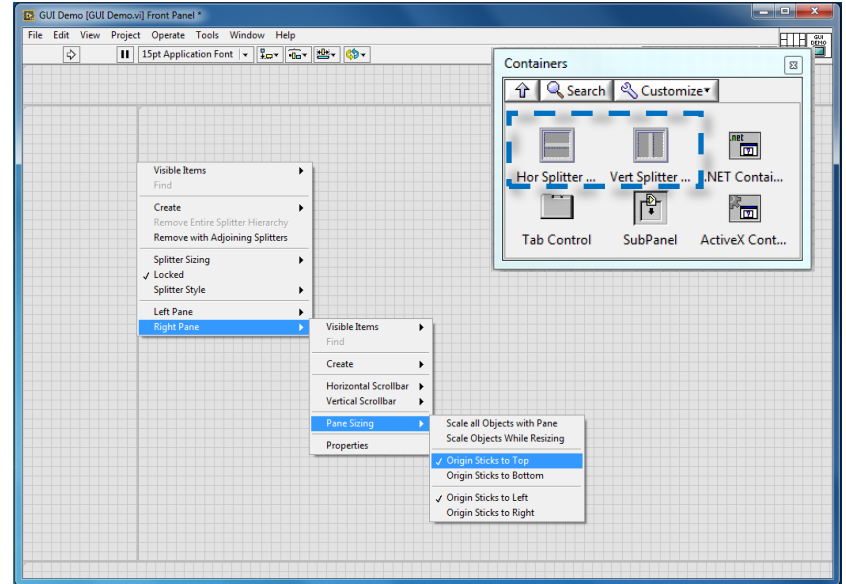


- 1 Panel bar
- 2 Group bar
- 3 Function group
- 4 Tooltip
- 5 Toolbar
- 6 Data Portal
- 7 Workspace
- 8 Status bar



Organizing Your Screen: Splitter Bars

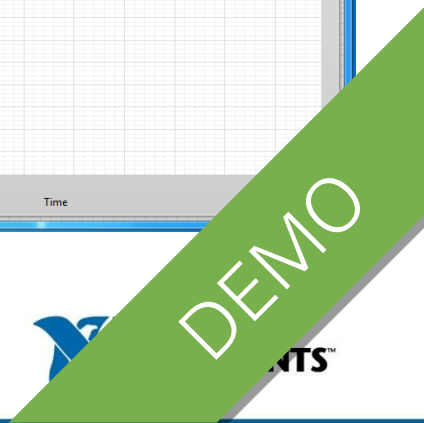
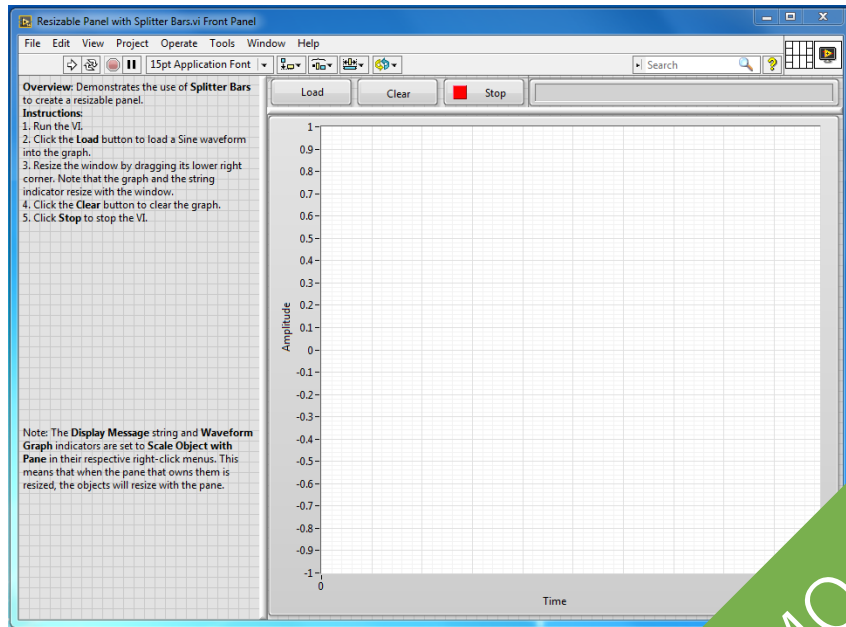
- Window division with horizontal and vertical splitter bars
- Hide scrollbars.
- Narrow splitter bars.
- Splitter bars can be locked or moved.
- Define origin when sizing the window area.



Splitter Bars

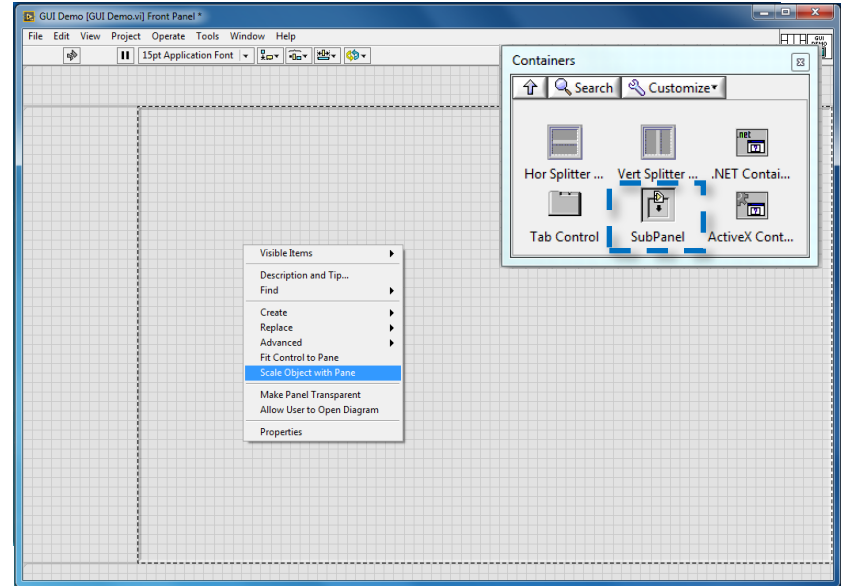
Divide front panel with splitter bars into several areas.

- Each window area behaves like a separate front panel.
- Each window area can have its own scrollbar.



Organizing Your Screen: Subpanels

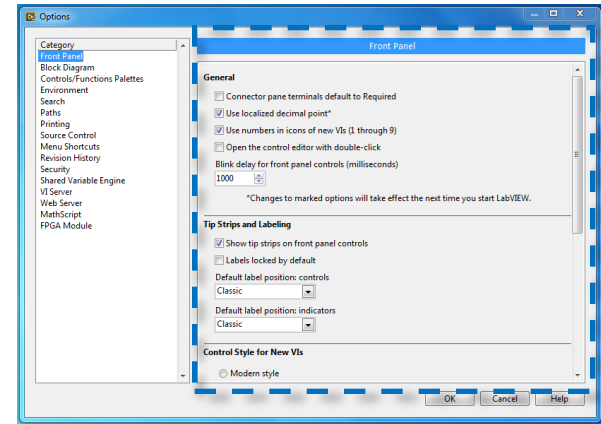
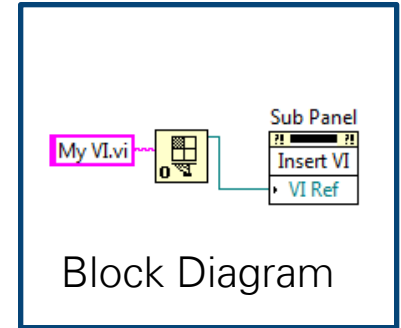
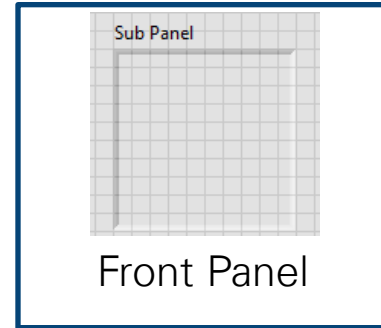
- Add subpanel for workspace.
- Hide labels and frames.
- Chose “Scale Object with Pane” to get a scalable workspace.



Using Subpanels to Display Front Panels

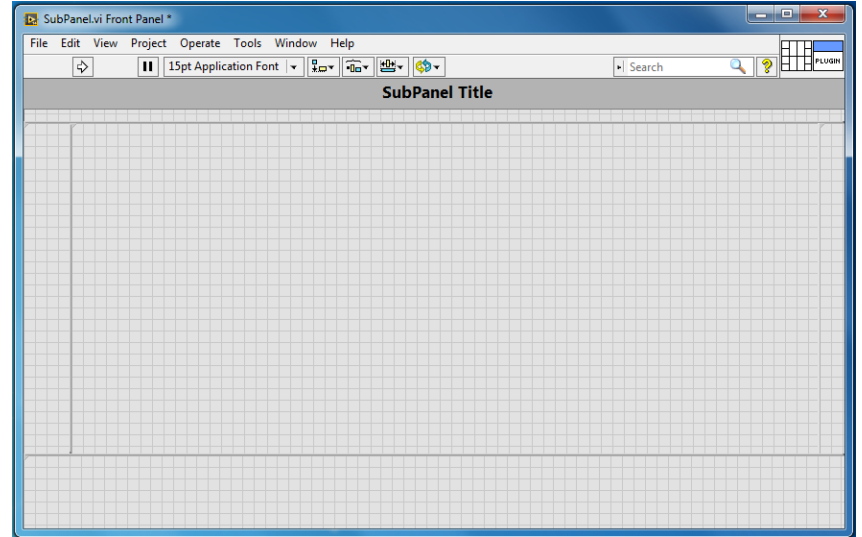
Integrate the front panel of another VI into your UI using subpanels

- Increases scalability and modularity
- You can divide a block diagram into several VIs (cf. Tab Control)



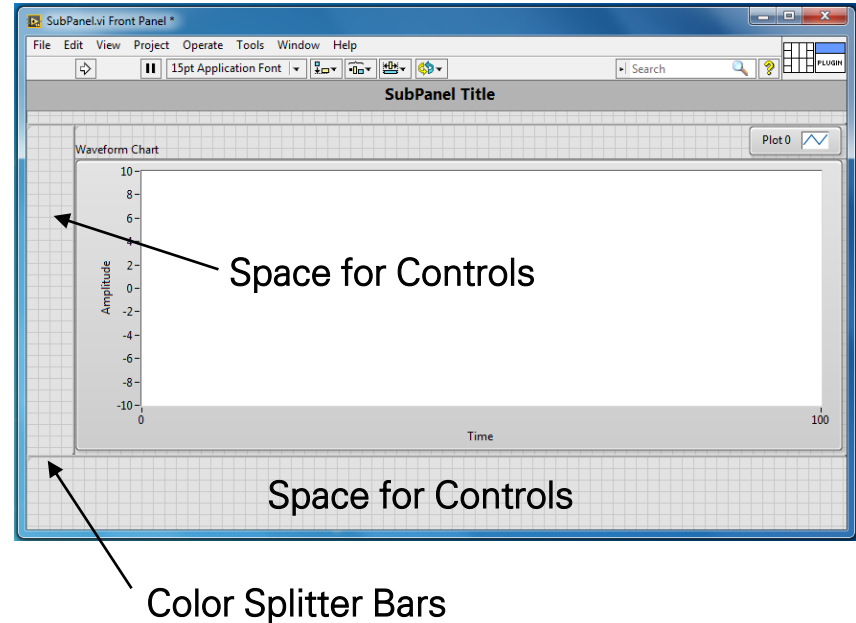
How to Organize the Subpanel Workspace

- Separate the subpanel with splitter bars.
- Set minimal window size.
- Define window title.



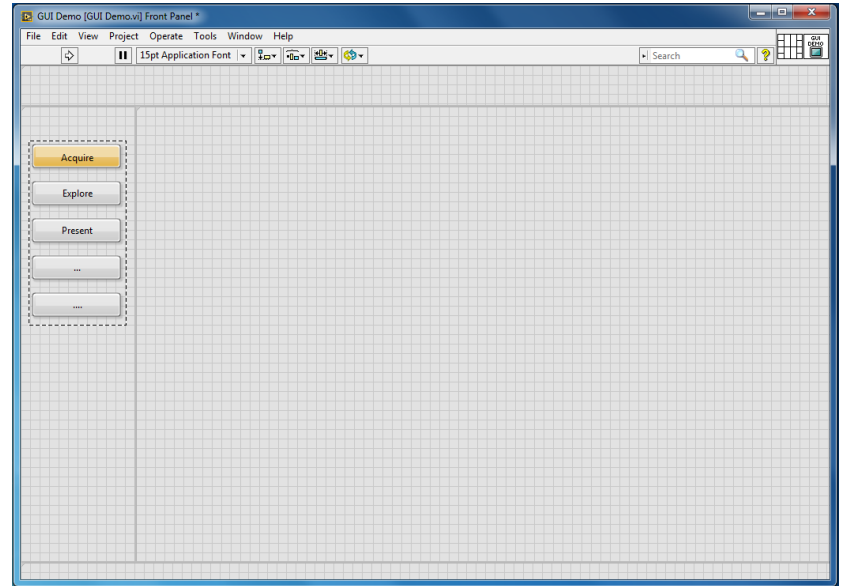
How to Organize the Subpanel Workspace

- Place control elements in a separate area, since you do not want controls to scale.
- Define scaling origin for control elements.
- You can hide splitter bars during execution by coloring them with the background color.

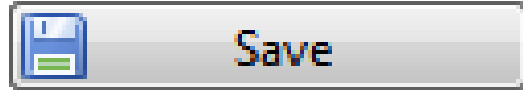
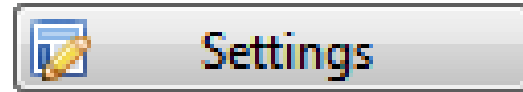
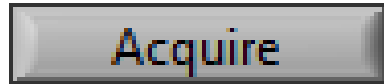


Organizing Your Screen: Panel Bar

- Add and arrange controls
- Define mechanical action
- Hide frames and labels

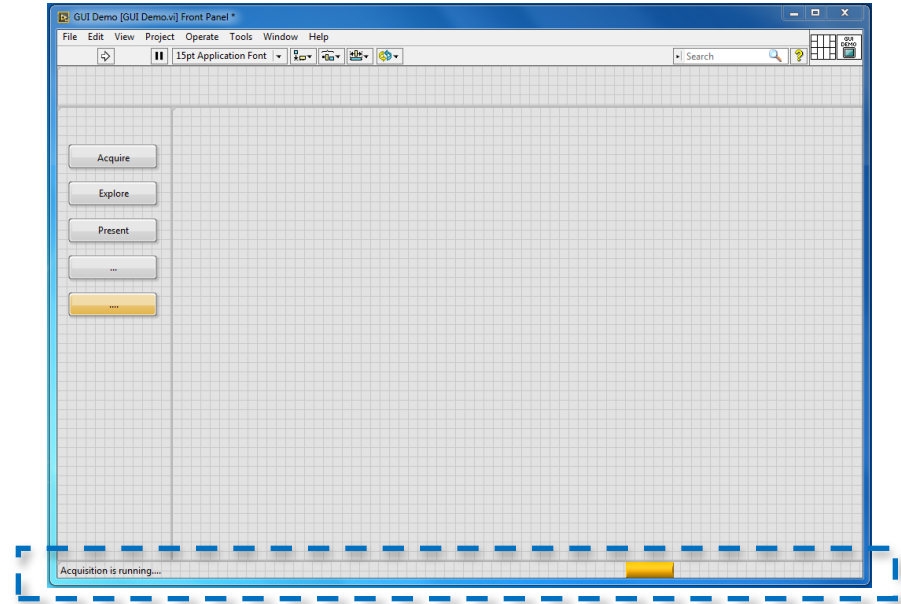


Add Decals to Buttons



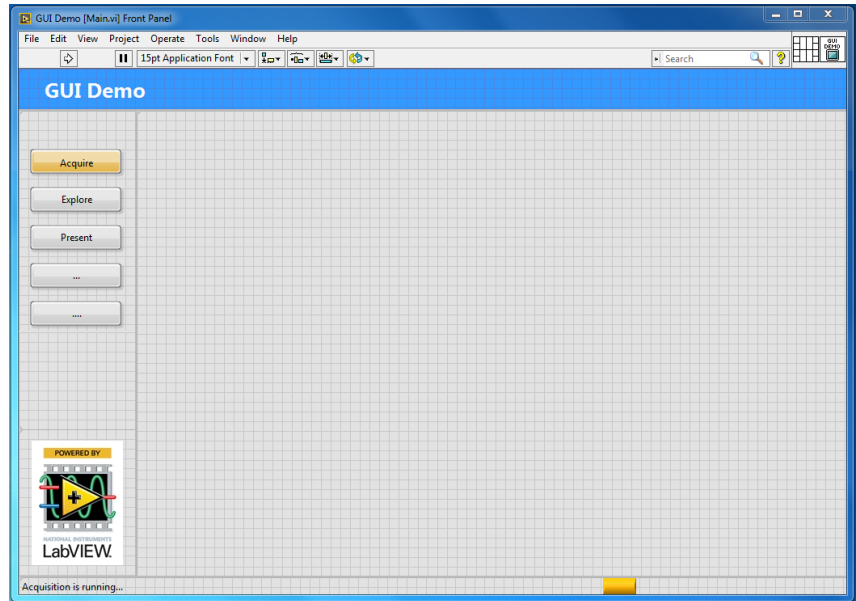
Organizing Your Screen: Status Bar

- Add string indicator and a state bar to the progress bar



Organizing Your Screen: Other Elements

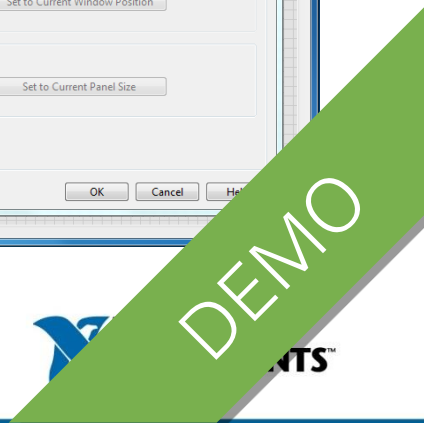
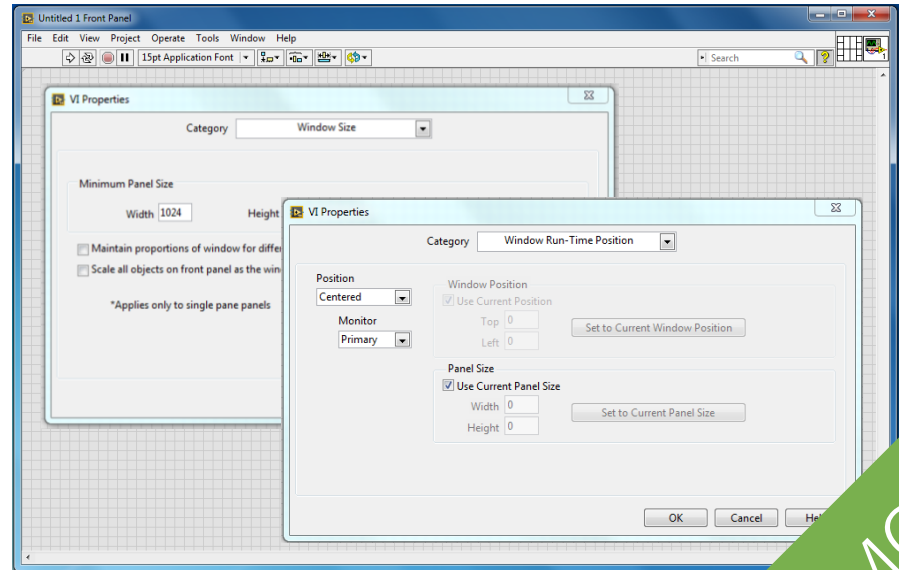
- Application name
- Company logo (optional)
- Help button (optional)



Window Size & Scaling

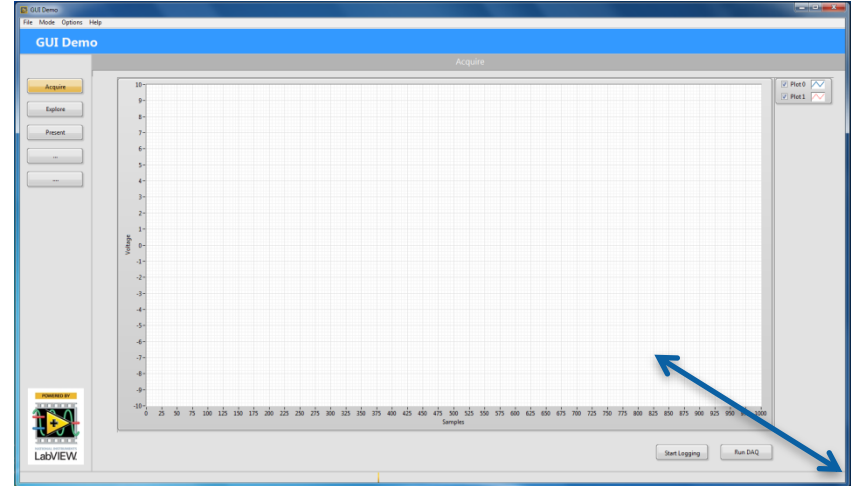
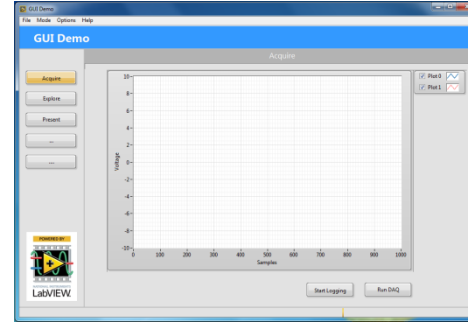
Setting Window Size

- Hide scrollbars
- Set minimal window size
- Set window position during run-time



Scaling Example

- Only the diagram scales with the window size, controls keep their size.
- A front panel with 1024x768 pixels fits on almost any screen and can be enlarged as required.

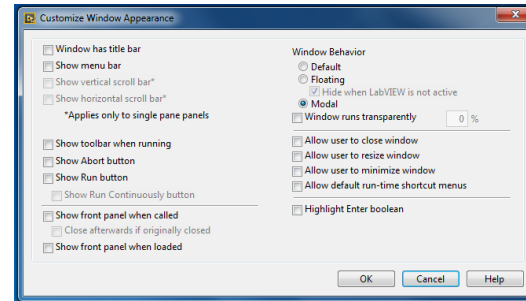
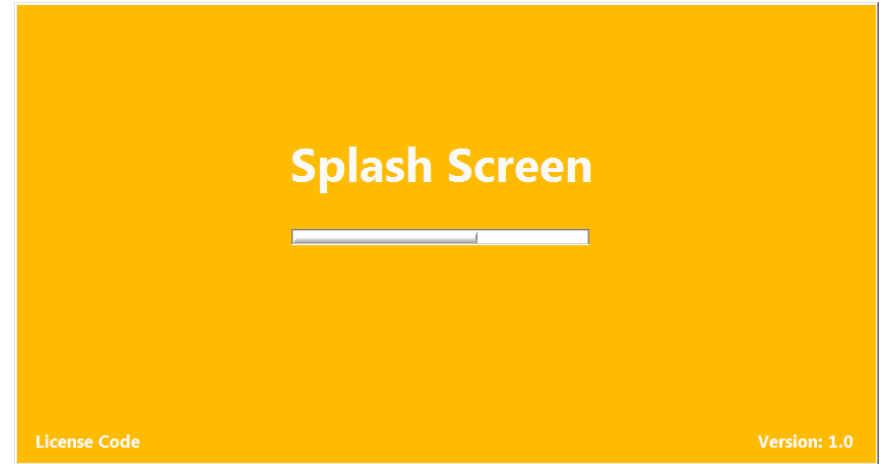


UI Design Elements

Startup Screen (Splash Screen)

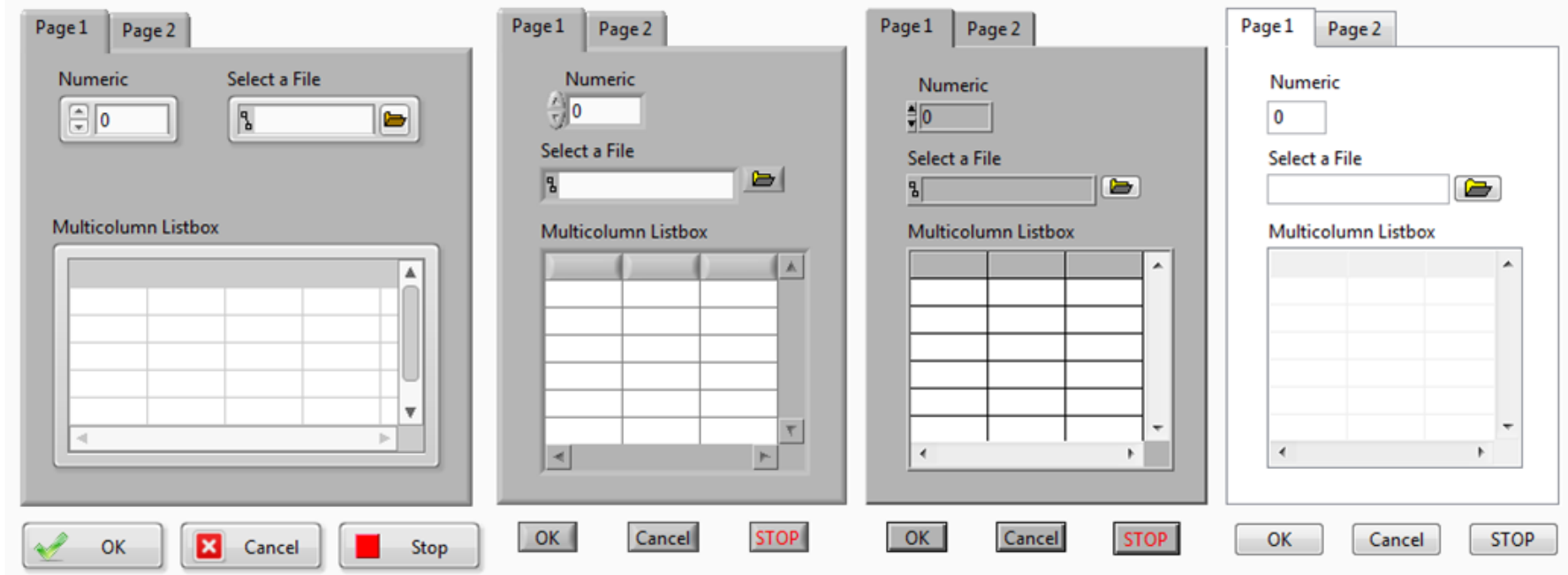
The startup screen informs the user about a program being loaded

- Usually, the startup screen does not fill the whole screen
- Customize window appearance



Front Panel Object Styles

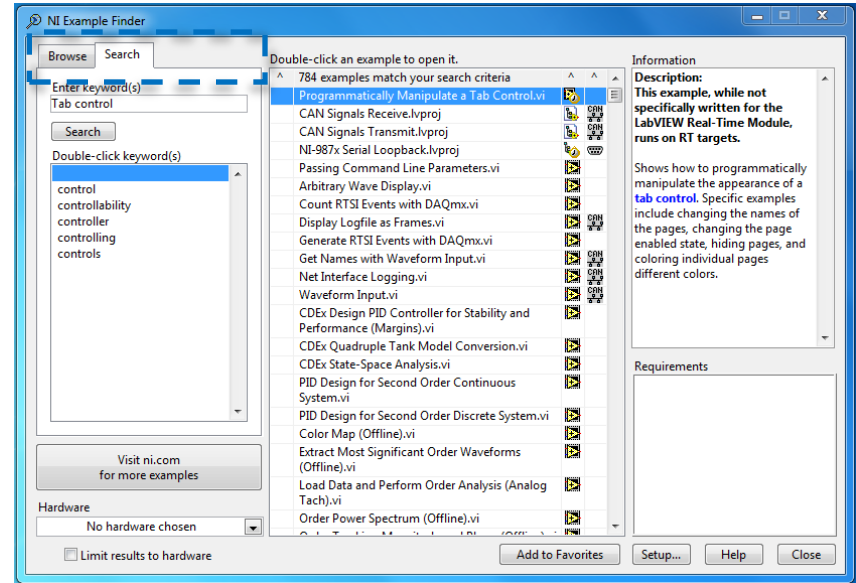
Display options for controls and indicators: "Silver", "Modern", "Classic", and "System"



Tab Control

Use to overlap several elements in a small front panel area

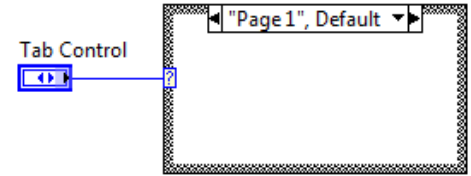
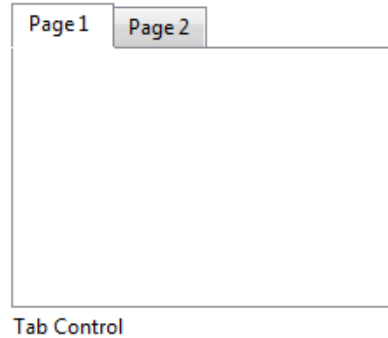
Note: The block diagram becomes confusing if the whole application is divided using tabs



Tab Control

Tip:

- You can wire the enumerated control terminal of the tab control to the selector of a Case structure to produce cleaner block diagrams.
- It is easier to structure a complete front panel with subpanels.



Tables

A lot of information can be displayed in a small space using a table

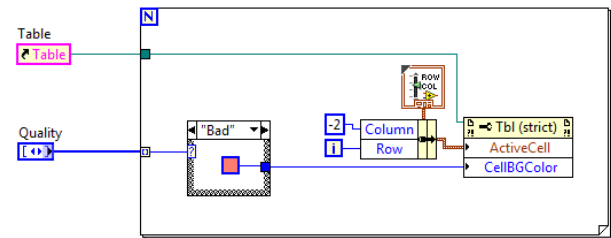
Coloring the cells helps to better categorize data

Table

Sample	Channel 0	Channel 1	Channel 2	Channel 3	
0	2.762	3.454	3.804	4.306	
1	3.255	3.681	4.139	4.632	
2	3.510	3.994	4.498	4.634	
3	3.782	4.345	4.387	4.753	
4	2.820	3.290	3.962	4.369	
5	3.244	3.581	4.255	4.468	

Table

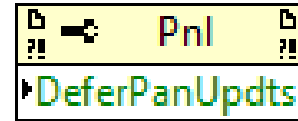
Sample	Channel 0	Channel 1	Channel 2	Channel 3	
0	2.762	3.454	3.804	4.306	
1	3.255	3.681	4.139	4.632	
2	3.510	3.994	4.498	4.634	
3	3.782	4.345	4.387	4.753	
4	2.820	3.290	3.962	4.369	
5	3.244	3.581	4.255	4.468	



Defer Panel Updates

Enabling front panel objects can be suspended.

- Increases the execution rate and avoids lagging when modifying large tables and graphs.



Table

Sample	Channel 0	Channel 1	Channel 2	Channel 3	
0	2.762	3.454	3.804	4.306	
1	3.255	3.681	4.139	4.632	
2	3.510	3.994	4.498	4.634	
3	3.782	4.345	4.387	4.753	
4	2.820	3.290	3.962	4.369	
5	3.244	3.581	4.255	4.468	

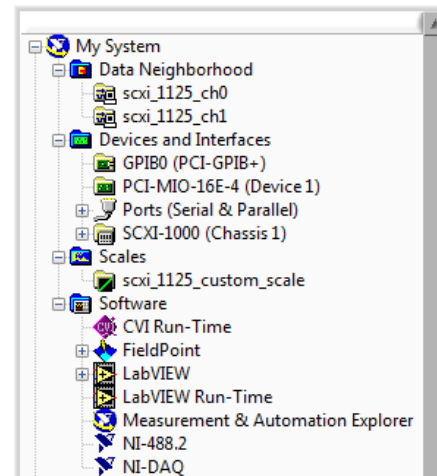
Tree Controls

For complex UIs, you can use tree controls instead of a panel bar

- Entries of tree controls are grouped in categories.
- You can add custom symbols to the tree controls.

Tree

Object	First Attribute	Second Attribute
First Object	Sample 1	Sample 2
Copy	Sample 3	Sample 4
Copy	Sample 5	Sample 6

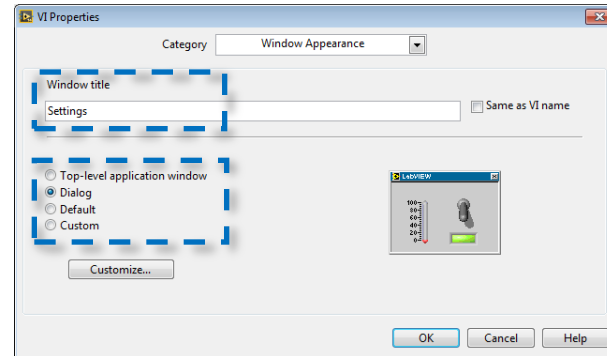
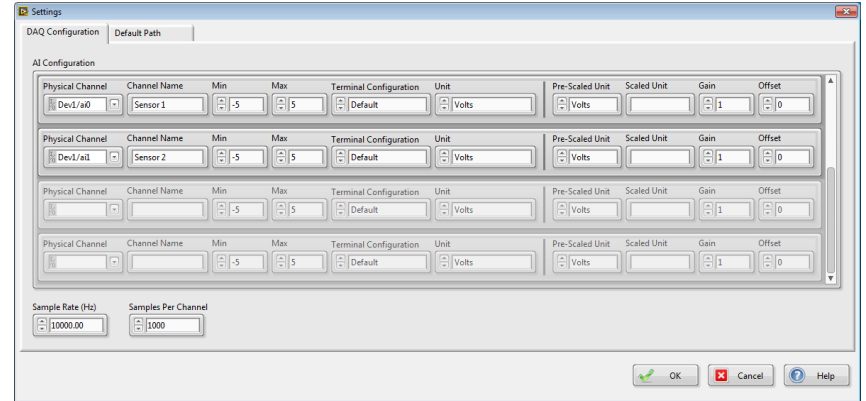


Dialog

Dialog boxes stay in the foreground and do not have menu bars, scrollbars, or toolbars.

- Windows cannot be resized

Note: The calling loop of the dialog is being blocked until the dialog is closed again.



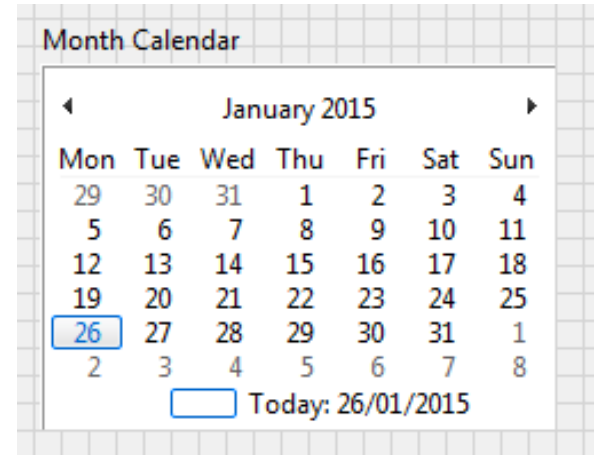
.NET Control

Benefit

- Greatly reduces programming time
- Very powerful

Disadvantage

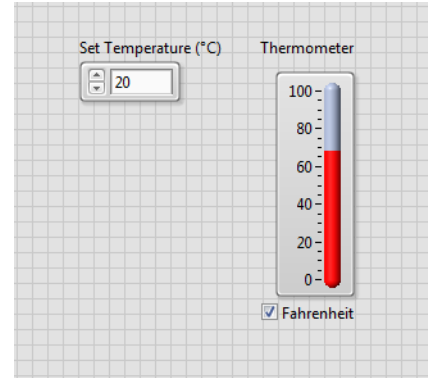
- Only supported on Windows platform
- Compatibility between different .NET not guaranteed



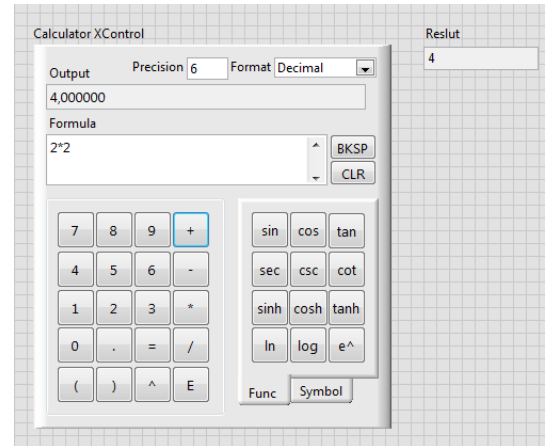
XControl

XControls add functionality to indicators or controls.

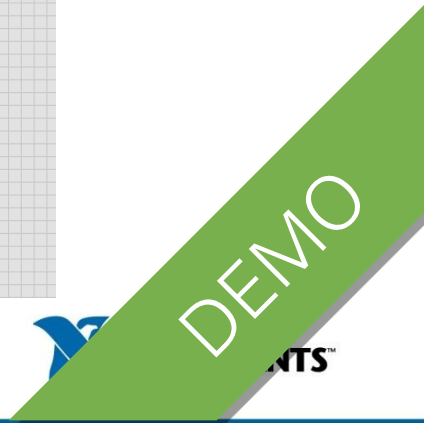
- You can create complex controls and indicators, without the user having to understand the underlying functionality.



Set Temperature (°C) Thermometer

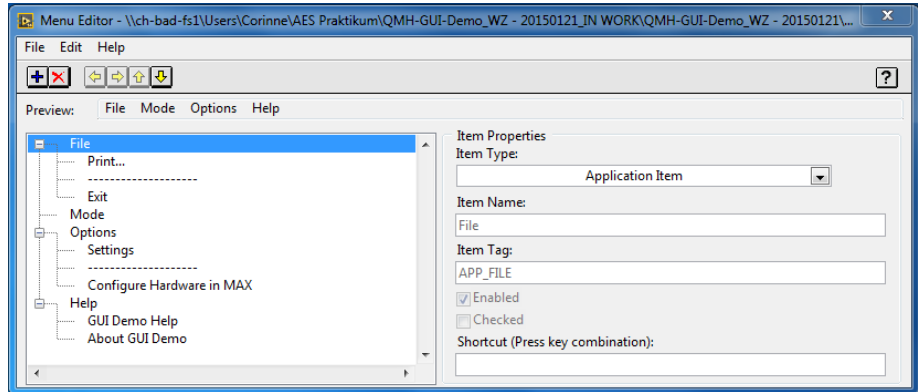
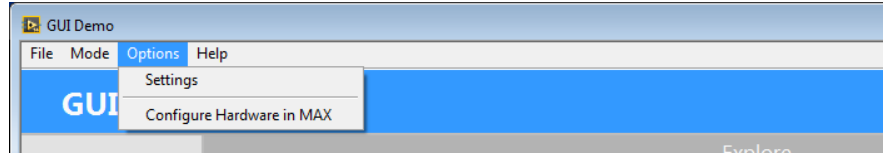


Calculator XControl Result



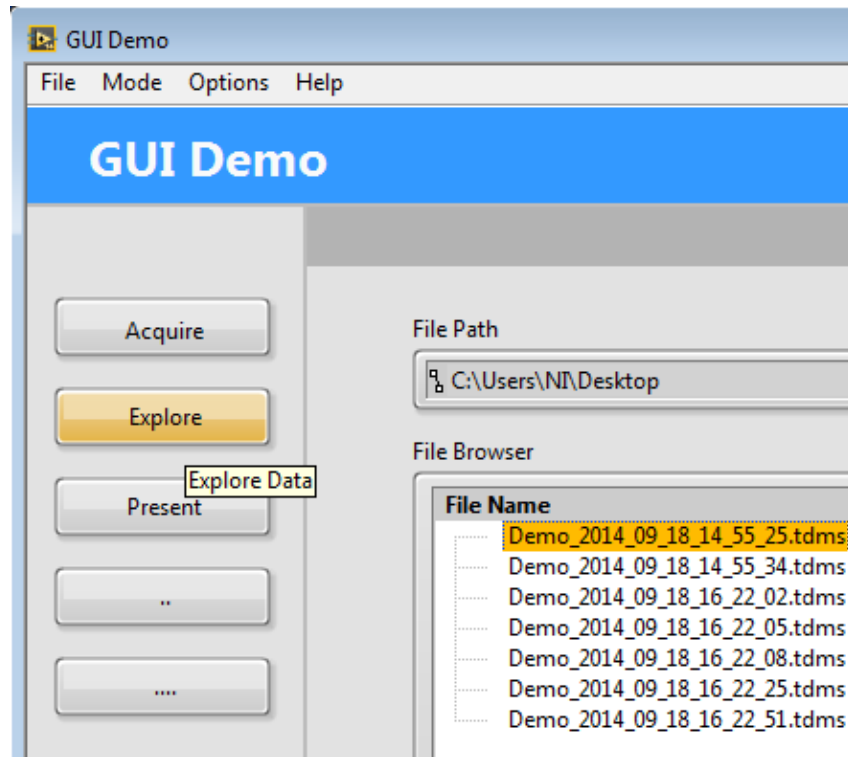
Customize Menu

- Edit >> Run-Time Menu



Tip Strips

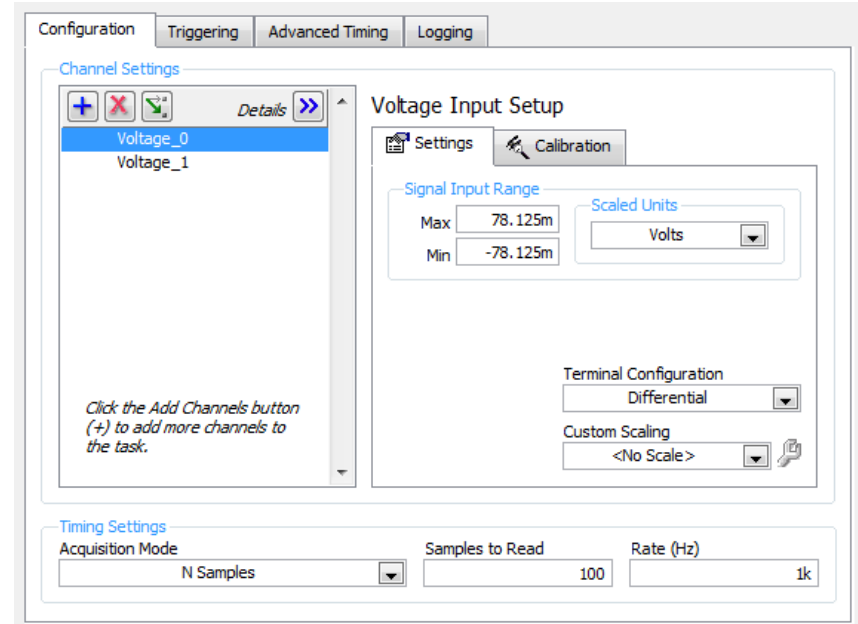
Short descriptions that pop up when you move your cursor over an object during VI execution



Decorations

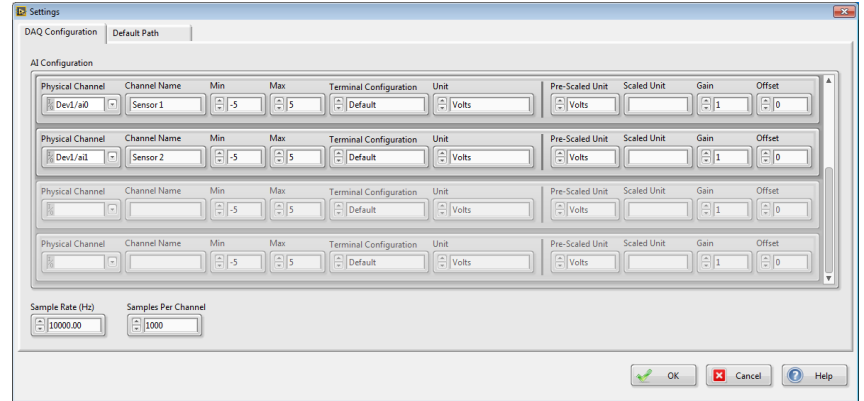
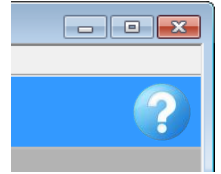
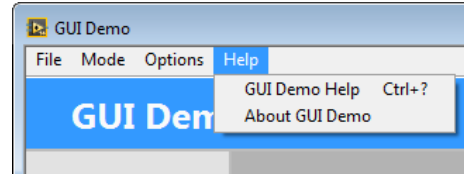
Decorations group or separate front panel objects without any impact on the function of a VI

- Decorations include frames, lines, and arrows



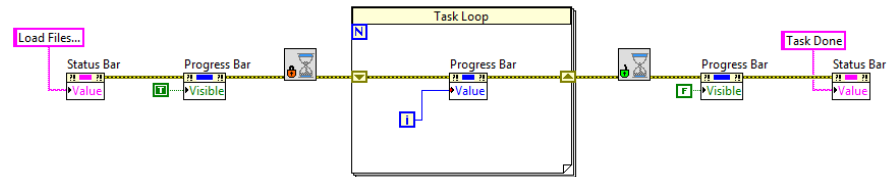
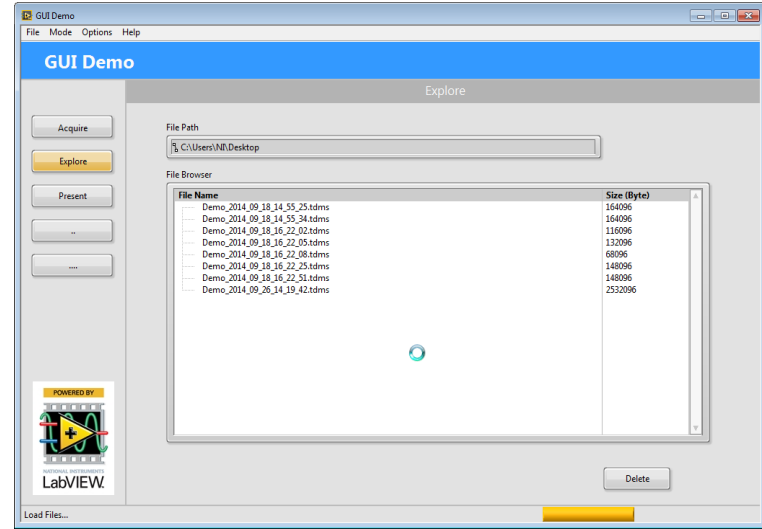
Help

Program should support the user by offering help



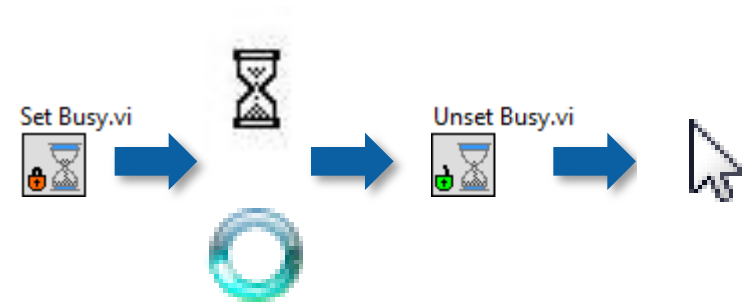
Status Information for Users

Status bars, progress bars, and cursors inform users about the status of the application.

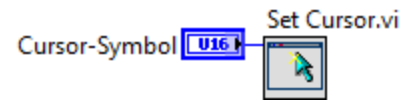


Adapt Cursor

Hourglass cursor informs user to wait



Cursor symbol informs user about required action.



Fonts and Text Characteristics

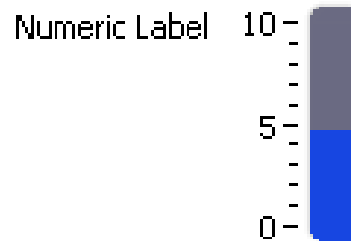
Standard fonts vary depending on the platform

Limit VI to the three standard fonts:

- Application
- System
- Dialog

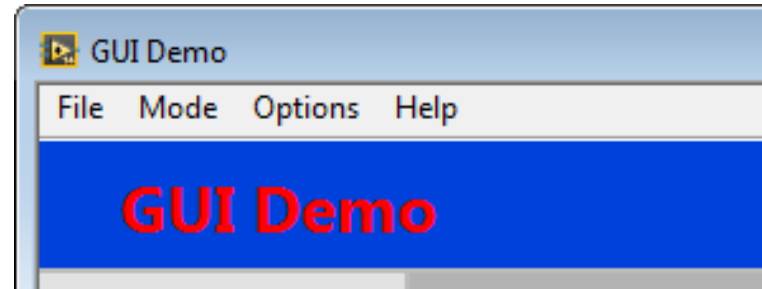
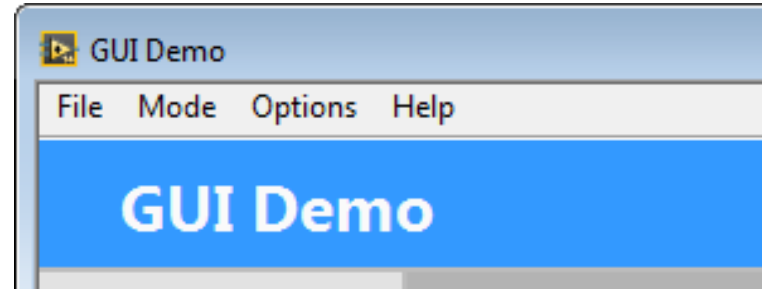
Text size

- Leave room for font to expand or contract
- Set the label/text box to Size to Text



Using Colors

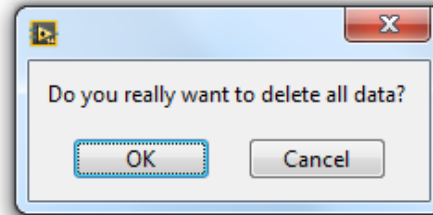
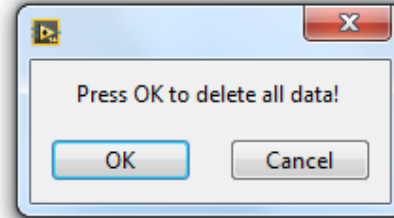
- Use colors sparingly
- Favor pastel shades
- Do not use saturated colors
- Use a maximum of 5 meaningful colors
- Be careful when using contrasting colors



Formulate Dialogs Properly

When a dialog describes an action, the user is enticed to execute that action without considering the consequences

Better: Describe the "effect" of the action.



Touchpanel User Interface

- Controls should be easy to use with fingers.
- Ensure sufficient spacing between controls to avoid wrong choices.



EN ISO 9241

The standard EN ISO 9241 contains regulations for human-computer interaction and is made up of multiple parts.

EN ISO 9241

EN ISO 9241

Visual display requirements (part 3)

Requirements for displayed colors (part 8)

Presentation of information (part 12)

User guidance (part 13)

Menu dialogs (part 14)

Dialog principles (part 110)

Guidance on software individualization (part 129)

...