UI Design: Ideas, Concepts, Suggestions

Wolfgang Zwick, National Instruments Germany GmbH



germany.ni.com

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



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?





Doptionen	
Kategorie A	Frontpanel
Blockdiagramm Elemente- und Funktionenpalette Umgebung Suchen Pfade Drucken Versionsverwaltung Menüverknüpfungen Versionshistorie Sicherheit Engine für Umgebungsvariablen VI-Server Webserver	Allgemein Anschlussfeldanschlüsse standardmäßig erforderlich V Lokales Dezimalzeichen verwenden* Zahlen in Symbolen neuer VIs verwenden (1 bis 9) Element-Editor durch Doppelklick öffnen Blinkpause für Frontpanel-Elemente (in ms) 1000 * Änderungen werden erst bei einem Neustart von LabVIEW wirksam. Hinweisstreifen und Beschriftung Ø Tipps an Frontpanel-Elementen anzeigen Beschriftungsposition: Bedienelemente Klässisch Standard-Beschriftungsposition: Anzeigeelemente Klassisch Elementdarstellung in neuen VIs @ Modern
	OK Abbrechen Hilfe

Contextual relationships should be displayed visually as a unit.

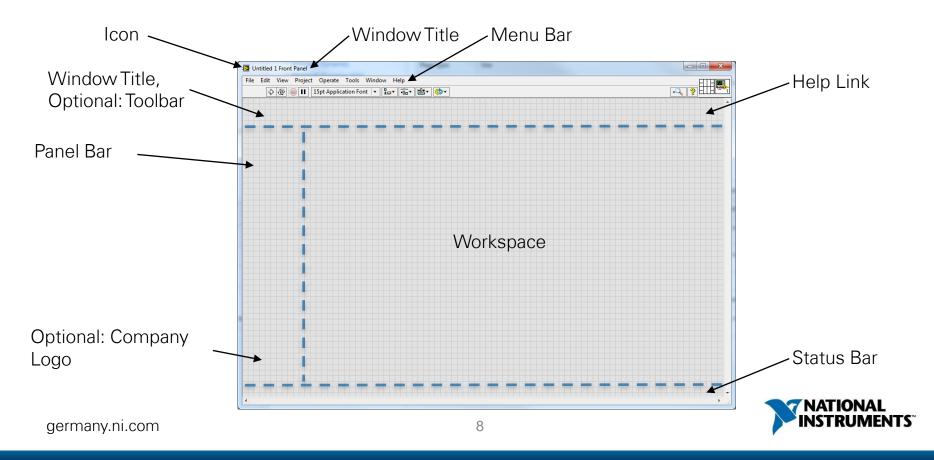


Organizing Your Screen

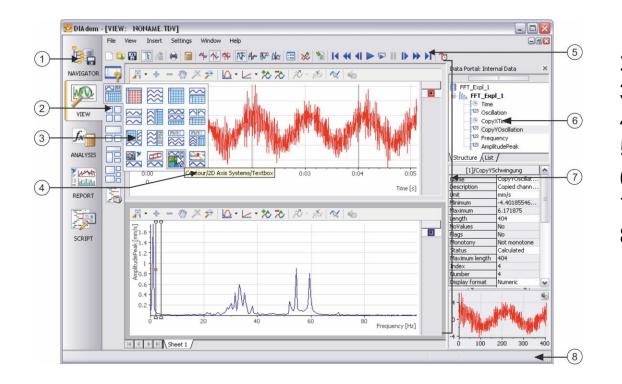


germany.ni.com

Typical Screen Layout



Screen Layout: DIAdem Example



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

OFFMO TS

8 Status bar

germany.ni.com

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.

e Edit View Project Operate Tools Window Help					ETH.
↓ II 15pt Application Font ▼ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	· 변· 🔅 ·		Containers		8
Visible kerns Find Create Create Remove Kith Adjoining Splitters Splitter Sing Locked Splitter Syle				Vert Splitter SubPanel	
Left Pane					
Right Pane 🕨	Visible Items Find Create Horizontal Scrollb Vertical Scrollbar	→ ar →			
	Pane Sizing	Scale all Ob	jects with Pane		
	Properties	Scale Objec	ts While Resizing		
		✓ Origin Stick			
		Origin Stick ✓ Origin Stick Origin Stick			



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.

11

File Edit View Project Operate Tools Wi	ndow Help				HIH
💠 🕸 🔘 🚺 15pt Application Font	• 1.0• iii•	≝ ∗ 🔅 -		► Search	? HIH 🖳
Dverview: Demonstrates the use of Splitter Bars to create a resizable panel. instructions:	Load	Clear	Stop		
I. Run the VI.	1-				
 Click the Load button to load a Sine waveform nto the graph. 	0.9-				
 Resize the window by dragging its lower right 	0.8-				
corner. Note that the graph and the string ndicator resize with the window.	0.7 -				
I. Click the Clear button to clear the graph. 5. Click Stop to stop the VI.	0.6-				
	0.5-				
	0.4 -				
	0.3-				
	10.1-				
	-0.2 - Wind				
	-0.1 -				
	-0.2 -				
Note: The Display Message string and Waveform	-0.3 -				
Graph indicators are set to Scale Object with Pane in their respective right-click menus. This	-0.4 -				
means that when the pane that owns them is	-0.5 -				
esized, the objects will resize with the pane.	-0.6 -				
	-0.7 -				
	-0.8 -				
	-0.9 -				
	-1-				

Organizing Your Screen: Subpanels

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

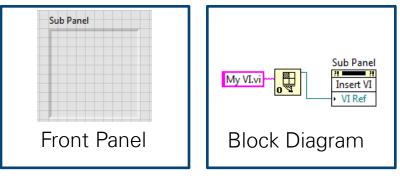
🛃 GUI Demo [GUI Demo.vi] Front Panel *		
File Edit View Project Operate Tools Wine	dow Help	HTHE
🔹 🚺 15pt Application Font 🗸	】 \$ov ● ● ▼ ● ◆ ▼	Containers 🛛
		🕆 🔍 Search 🖏 Customize▼
		Hor Splitter Vert SplitterNET Contai
		Tab Control SubPanel ActiveX Cont
	Visible Items	
	Description and Tip Find	
	Create Replace Advanced Fit Control to Pane	
	Scale Object with Pane	
	risble kens risble kens risble kens risble kens treate papice t Control Dane cade Object with Pane dake Panel Transport slow User to Open Diagram	
	Properties	

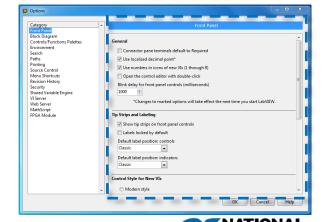


Using Subpanels to Display Front Panels

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

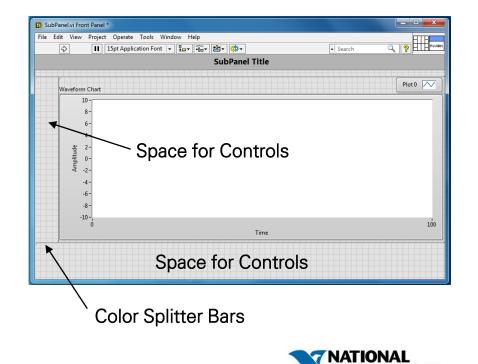
- Separate the subpanel with splitter bars.
- Set minimal window size.
- Define window title.

🖪 S	ubPanel.vi Fro	ont Pane	4 *													- 0	
File	Edit View															F	PLUGIN
	\Rightarrow	- 11	15pt App	lication Fo	nt 🖃	*	•	<u>*</u> *	\$				► Sea	arch	9	? H	PLUGIN
										l Titl	e						



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.



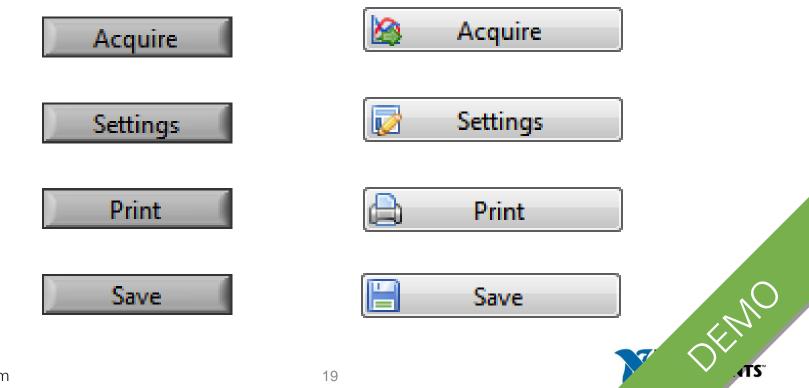
Organizing Your Screen: Panel Bar

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

Image: Second Secon	 Search 	
Acquire Explore Present		
Acquire processing and the second sec		
Acquire processing and the second sec		
Acquire processing and the second sec		
Acquire processing and the second sec		
Acquire Explore Present		
Explore Present		
Present		
Present		



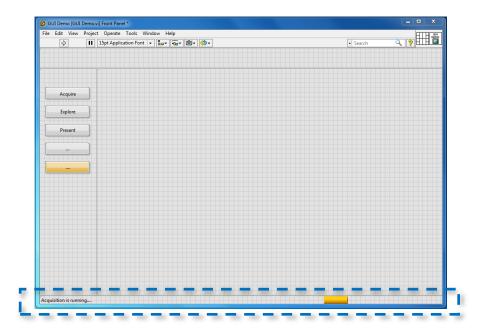
Add Decals to Buttons



germany.ni.com

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)

	roject Operate Tools Wind 15pt Application Font		Search	? III
\$	I ISpt Application Font ▼	 • 6 9 •	► Search	
GUI De	mo			
A				
Acquire				
Explore				
	J			
	`			
Present				
	`			
POWERED BY				
LabVIEW.				



Window Size & Scaling



germany.ni.com

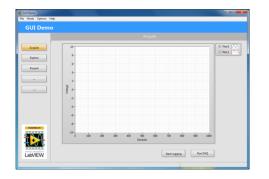
Setting Window Size

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

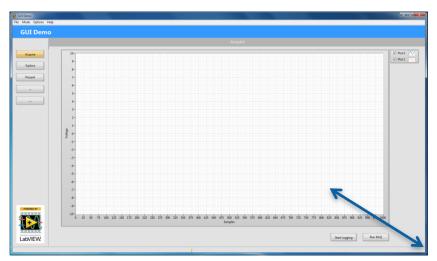
lit View Project Operate Tools Window Help			HITH MIL
수 🛞 🖲 🔲 15pt Application Font 🔻 🗫 🙃 🖄 🕬 🗸		• Search	, , , HE
VI Properties			
Category Window Size			
Minimum Panel Size			
Width 1024 Height E VI Properties			22
Maintain proportions of window for diffe Scale all objects on front panel as the win *Applies only to single pane panels Monitor Primary •	Top 0 Left 0 Panel Size	Window Position	

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.



25



UI Design Elements

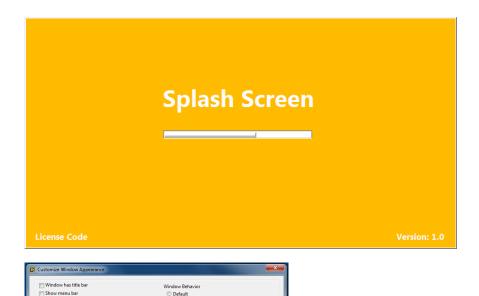


germany.ni.com

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



Floating

Modal

Window runs transparently

Allow user to resize window

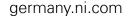
Highlight Enter boolean

Allow user to minimize window

Allow default run-time shortcut menus

OK Cancel Help

7 NATION



Show vertical scroll bar*

Show toolbar when running

Show Run Continuously button

Show front panel when called Close afterwards if originally closed Show front panel when loaded

Show Abort button

Show Run button

*Applies only to single pane panels

Front Panel Object Styles

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

Page 1 Page 2	Page 1 Page 2	Page 1 Page 2	Page 1 Page 2
Numeric Select a File	Numeric 0 Select a File	Numeric D Select a File D D D D D D D D D D D D D	Numeric 0 Select a File
Multicolumn Listbox	Multicolumn Listbox	Multicolumn Listbox	Multicolumn Listbox
OK Cancel Stop	OK Cancel STOP	OK Cancel STOP	OK Cancel STOP



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

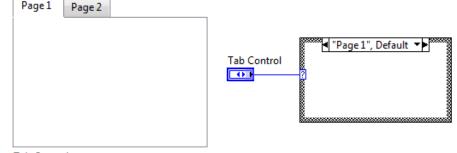
D NI Example Finder				
Browse Search D	ouble-click an example to open it.			Information
	^ 784 examples match your search criteria	^ ^	*	Description:
Enter Reyword(s) Tab control	Programmatically Manipulate a Tab Control.vi		Ξ	This example, while not
	CAN Signals Receive.lvproj	CEN CEN		specifically written for the LabVIEW Real-Time Module.
Search	CAN Signals Transmit.lvproj	CUM CUM CUM CUM		runs on RT targets.
Double-click keyword(s)	NI-987x Serial Loopback.lvproj	🏷 🌚		Tuis on RT urgets.
bouble click keyword(3)	Passing Command Line Parameters.vi	Ð		Shows how to programmatically
control	Arbitrary Wave Display.vi	Ð		manipulate the appearance of a
controllability	Count RTSI Events with DAQmx.vi	Ð		tab control. Specific examples
controller	Display Logfile as Frames.vi	E CAN		include changing the names of the pages, changing the page
controlling	Generate RTSI Events with DAQmx.vi			enabled state, hiding pages, and
controls	Get Names with Waveform Input.vi	🔁 ដូរ		coloring individual pages
	Net Interface Logging.vi	🔁 ភ្នំអ		different colors.
	Waveform Input.vi	E CAN		
	CDEx Design PID Controller for Stability and Performance (Margins).vi			
	CDEx Quadruple Tank Model Conversion.vi	Ð		· · ·
	CDEx State-Space Analysis.vi	Ð		Requirements
	PID Design for Second Order Continuous System.vi	Ð		
	PID Design for Second Order Discrete System.vi			
	Color Map (Offline).vi	Ð		
Visit ni.com	Extract Most Significant Order Waveforms (Offline).vi	A		
for more examples	Load Data and Perform Order Analysis (Analog Tach).vi	Þ		
No hardware chosen	Order Power Spectrum (Offline).vi	(D)	-	
I vo naroware chosen	0 1 T 1 1 1 1 10 (000) -	- 179901		
Limit results to hardware	Add to	Favorites		Setup Help Close



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.



Tab Control



Tables

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

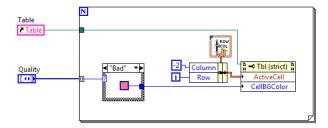
Coloring the cells helps to better categorize data

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	2 244	2 581	/ 255	1 168	

Table

Sample	Channel 0	Channel 1	Channel 2	Channel 3	4
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	2 244	2 581	// 255	1 168	

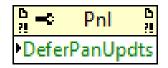




Defer Panel Updates

Enabling front panel objects can be suspended.

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



Table

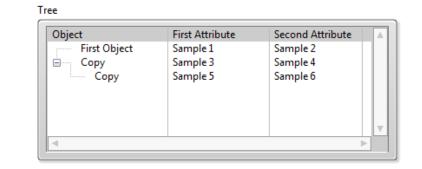
Sample	Channel 0	Channel 1	Channel 2	Channel 3	
0	2.762	3.454	3.804	4.306	
1	3.255	3.681	4.139	4.632	
2	3.510	3.994	4.498	4.634	
3	3.782	4.345	4.387	4.753	
4	2.820	3.290	3.962	4.369	
5	2 244	2 591	/ 255	1 168	

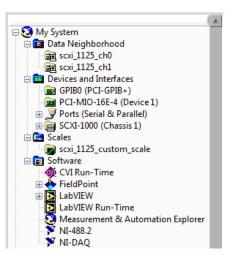


Tree Controls

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.







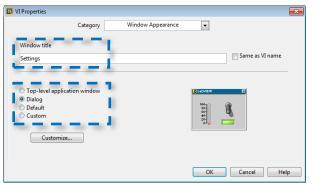
Dialog

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.

Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit Scaled Unit	Gain	Offset	
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit Scaled Unit	Gain	Offset	
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit Scaled Unit	Gain	Offset	
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit Scaled Unit	Gain	Offset	





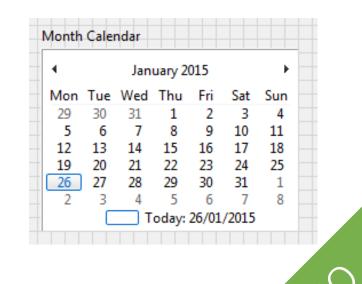
.NET Control

Benefit

- Greatly reduces programming time
- Very powerful

Disadvantage

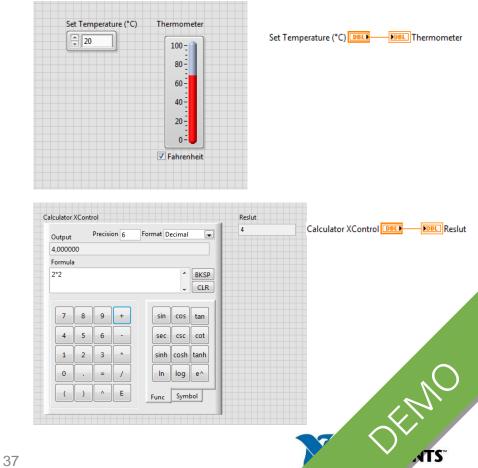
- Only supported on Windows platform
- Compatibility between different .NET not guaranteed



XControl

XControls add functionality to indicators or controls.

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



Customize Menu

Edit >> Run-Time Menu

🖪 G	UI Demo		
File	Mode	Options Help	
		Settings	
	GUI	Configure Hardware in MAX	
			- Evoloro

Menu Editor - \\ch-bad-fs1\Users\Corinne\AES Praktikum\QMH-GU	I-Demo_WZ - 20150121_IN WORK\QMH-GUI-Demo_WZ - 20150121\	x
File Edit Help		
+ ×		?
Preview: File Mode Options Help		
File A	Item Properties Item Type:	
 Exit	Application Item	
→ Mode → Options	File	
Settings	Item Tag:	
Configure Hardware in MAX	APP_FILE	
Help GUI Demo Help	Enabled Checked	
About GUI Demo	Shortcut (Press key combination):	
۲ (۱۹۹۵)		





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

🔄 GUI Demo		
File Mode Options	Help	
GUI Dem	0	
Acquire Explore Explore Dat Present 	ta	File Path C:\Users\NI\Desktop File Browser File Name Demo_2014_09_18_14_55_25.tdms Demo_2014_09_18_16_22_0.tdms Demo_2014_09_18_16_22_0.tdms Demo_2014_09_18_16_22_0.tdms Demo_2014_09_18_16_22_0.tdms Demo_2014_09_18_16_22_5.tdms Demo_2014_09_18_16



Decorations

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

> Decorations include frames, lines, and arrows

Configuration	Triggering	Advanced	Timing	Logging			
Channel Setti Volta Volta	De	etails 💓		Settings Settings Signal Inpu Max Min	R Cal	Scaled Units	
	Add Channels I 1 more channe	els to	•			Terminal Configuratio Differential Custom Scaling <no scale=""></no>	n V
—Timing Setting Acquisition Ma		4	T	Samples	to Read	Rate (Hz)	1k





Program should support the user by offering help

🖪 G	UI Demo				
File	Mode	Options	Help		
	GUI	Den		I Demo Help out GUI Demo	Ctrl+?

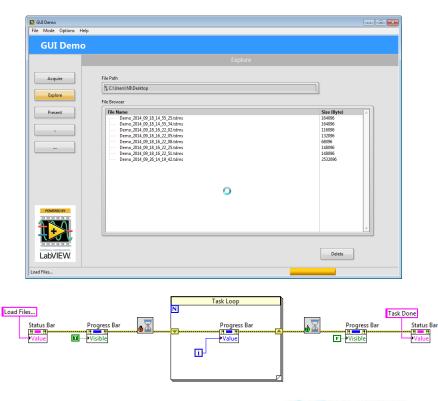


ettings										
Q Configuration	Default Path									
I Configuration										
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit	Scaled Unit	Gain	Offset	
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit	Scaled Unit	Gain	Offset	
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit	Scaled Unit	Gain	Offset	
Physical Channel	Channel Name	Min	Max	Terminal Configuration	Unit	Pre-Scaled Unit	Scaled Unit	Gain	Offset	



Status Information for Users

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





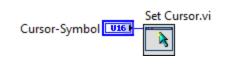
germany.ni.com



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



10 -

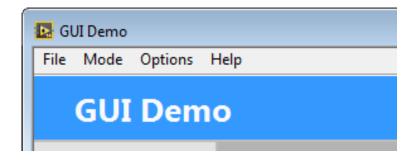
n –

Numeric Label



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





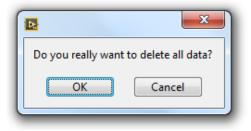


Formulate Dialogs Properly

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)



germany.ni.com