

INSTRUMENTATIE VIRTUALA

CURS 2-3

Cuprins

2

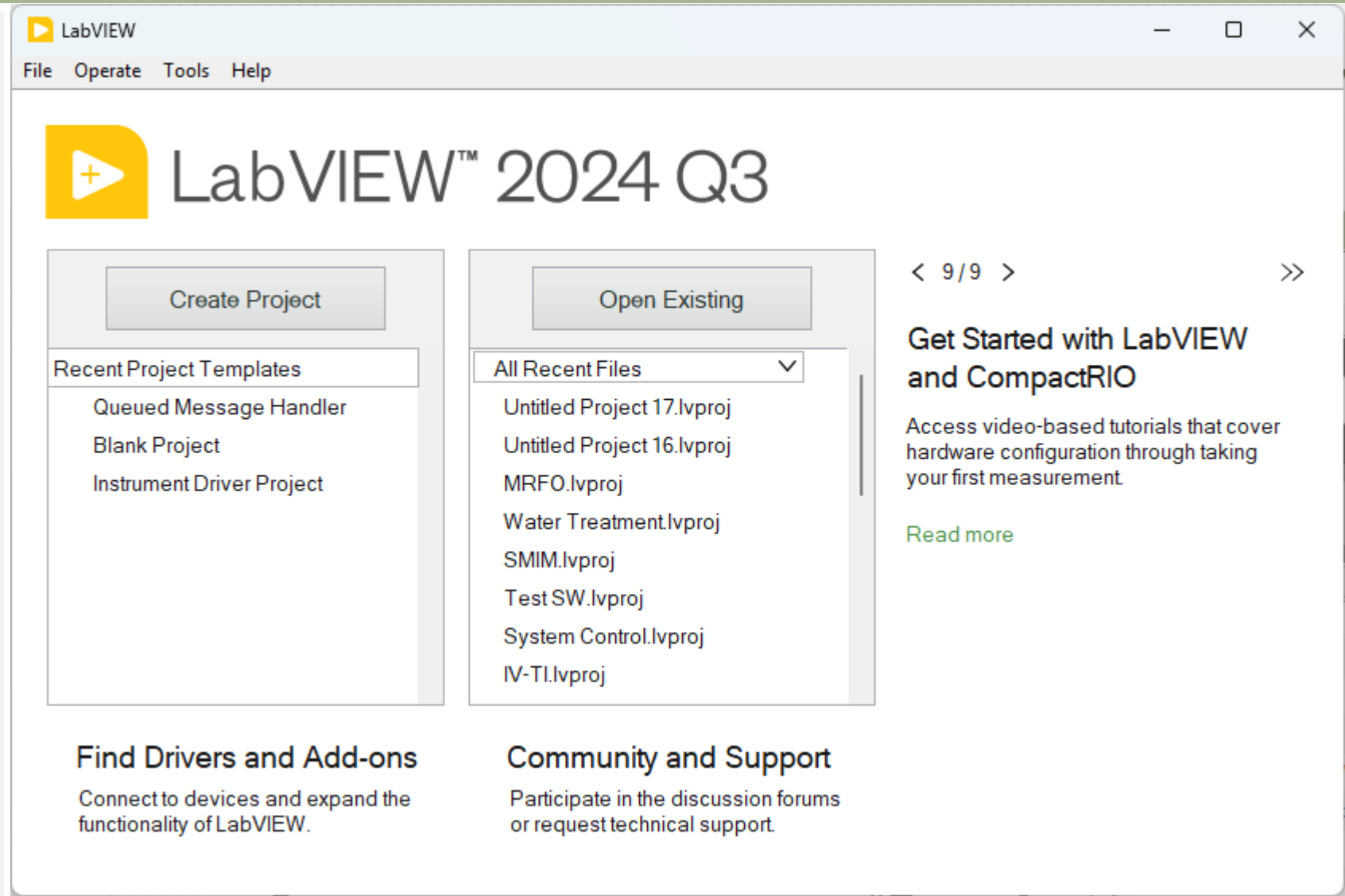
- Mediu de programare grafică LabVIEW
 - Noțiuni de bază
 - Ferestre de lucru, uneltele, paletele de controale și funcții
 - Elemente de programare - Programarea modulară



Familiarizarea cu mediul de programare LabVIEW – ferestre, meniuri, tools-uri

Deschiderea aplicatiei LabVIEW

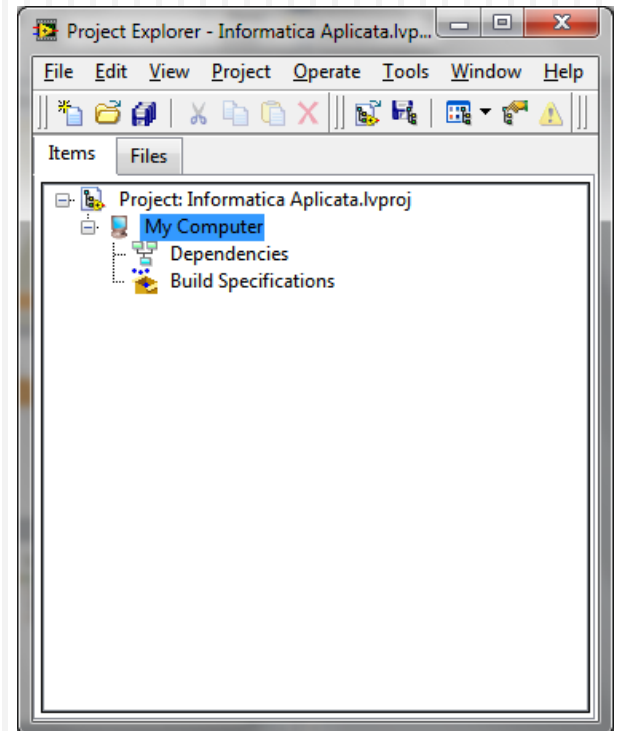
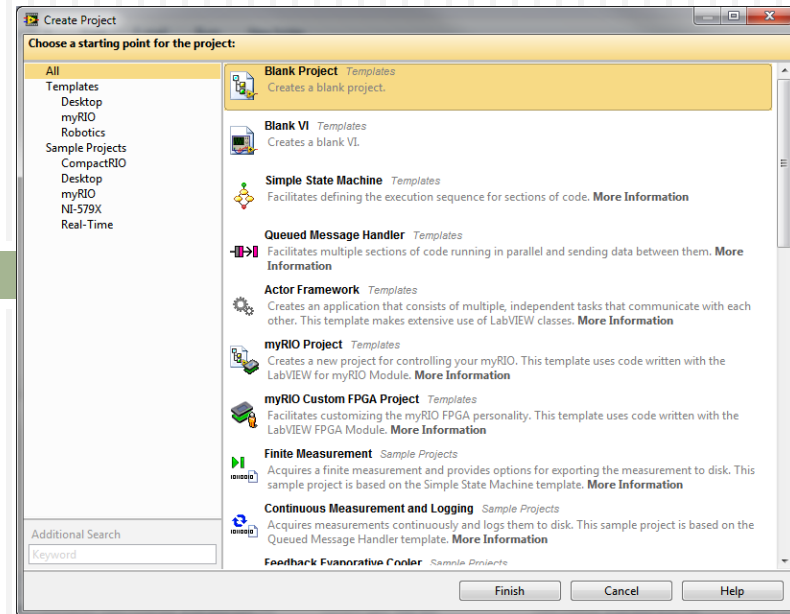
4



Lucru cu proiecte

5

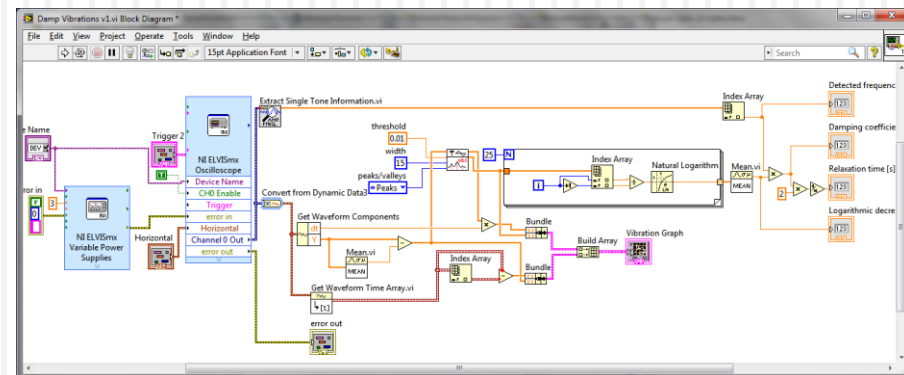
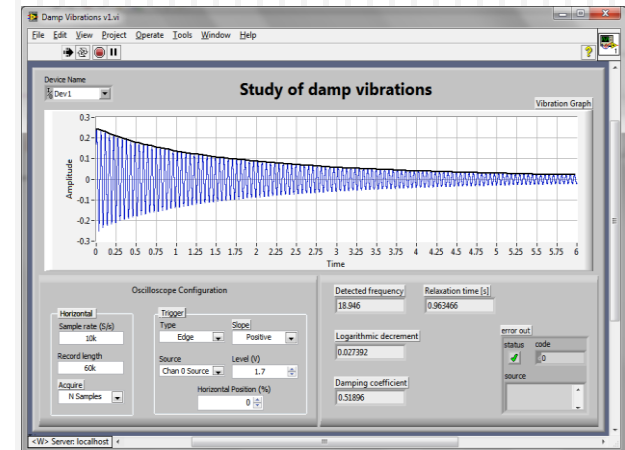
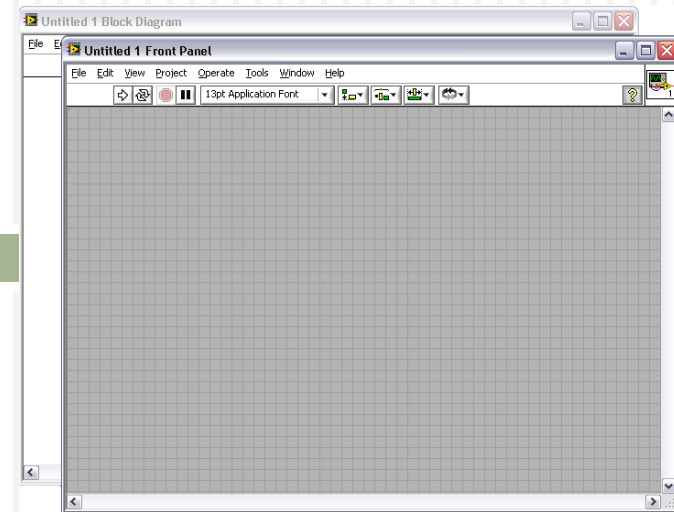
- Permite:
 - gruparea de fișiere LabVIEW și non LabVIEW
 - Realizarea de aplicații executabile
- la deschiderea platformei LabVIEW se va alege opțiunea Create Project
- Adăugarea de noi fișiere
 - My Computer >> New >> VI



Un Instrument Virtual (VI)

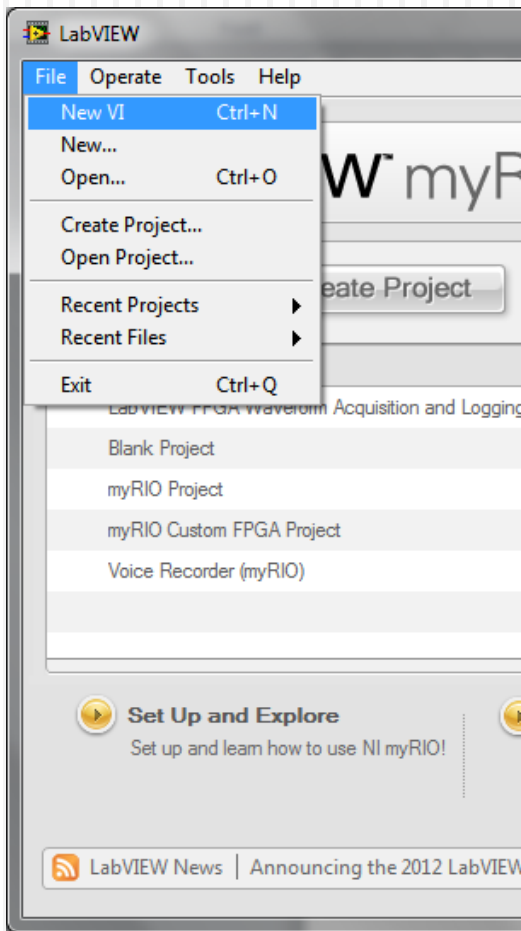
6

- Are un PANOU
 - Controale = Intrari
 - Indicatoare = Iesiri
- Are o DIAGRAMA
 - De fapt este programul realizat grafic folosind elementele din PANOU
 - Iconurile (module) legate functional cu fire



Realizarea primului VI

7

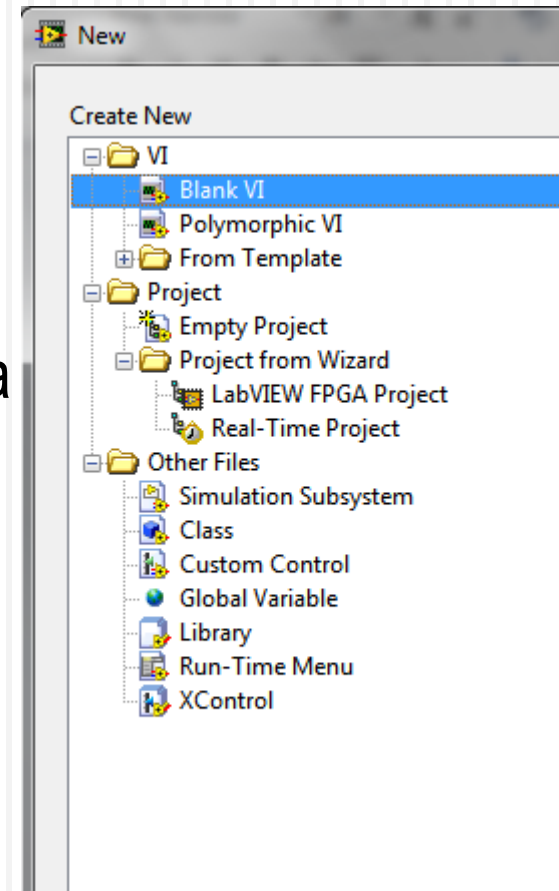


Deschidem un nou VI

- Selectati File»New VI

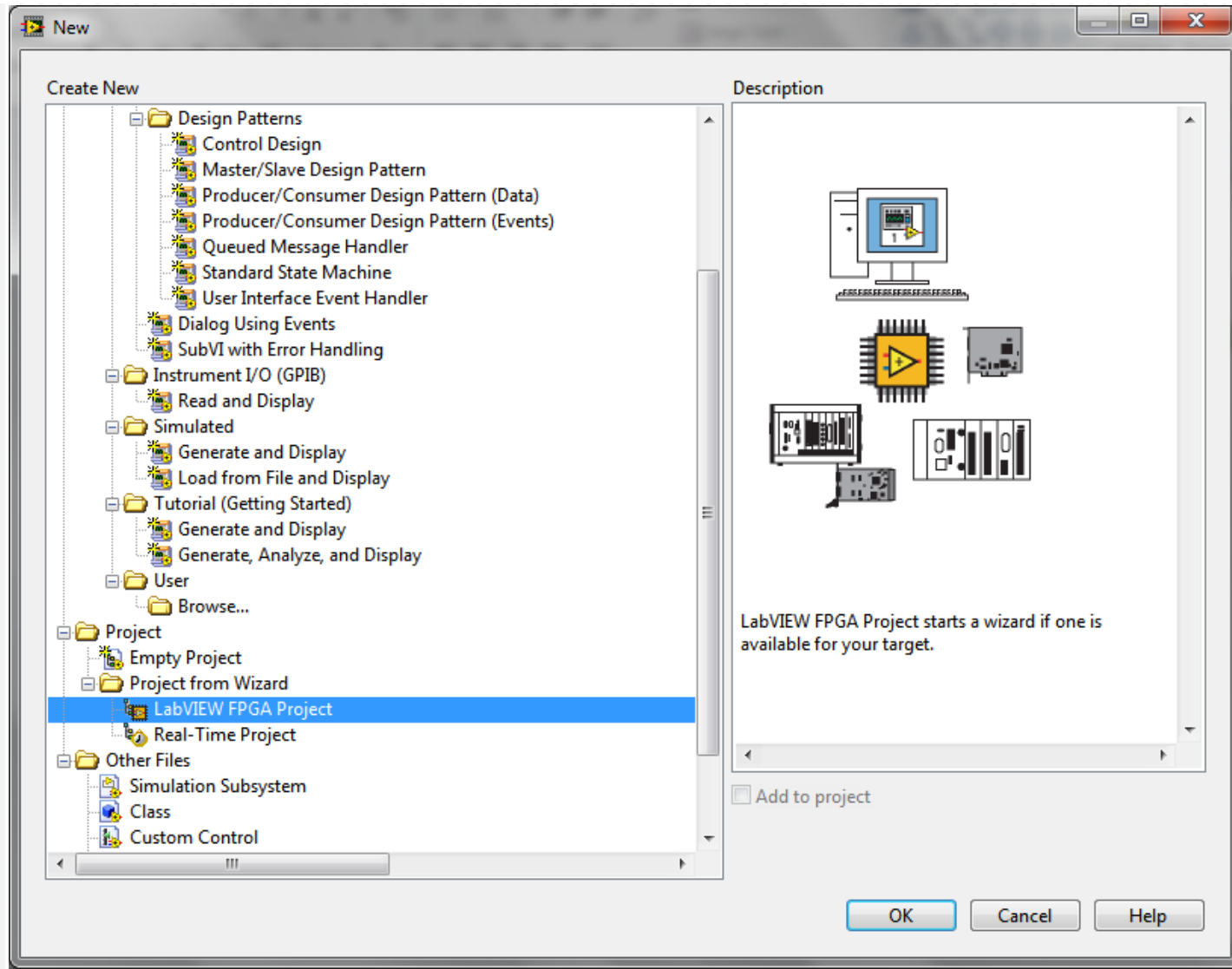
Sa deschidem o noua casuta de dialog New

- Selectati File»New
- Click Blank VI



Template-ul de Browser

8



Lucru cu Project Explorer

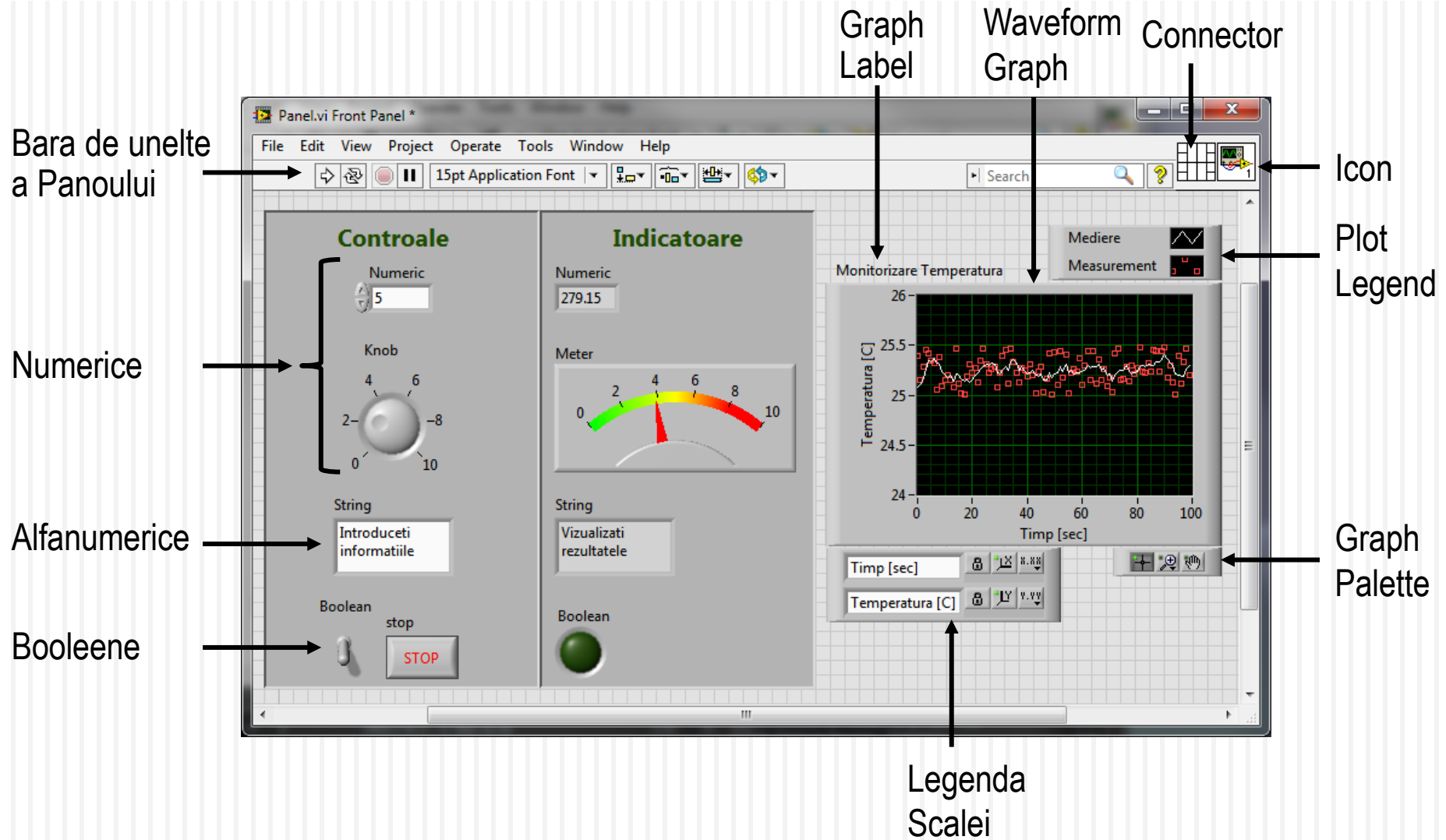
9



- Demonstratie
 - ▣ Deschidere LabVIEW
 - ▣ Crearea unui nou proiect
 - ▣ Adaugarea de fișiere
 - ▣ Gruparea fișierelor
 - ▣ Stergerea fișierelor

Fereastra PANOU => interfata utilizator

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Bara de unelte in Panou si Diagrama



Rulare simpla

Rulare continua

Oprire (abort)

Pauza/Continua

Configurare Fonturi

Aliniere

Distribuire

Redimensionare

Reordonare

Cautare globala

Help

contextual



Atentionare



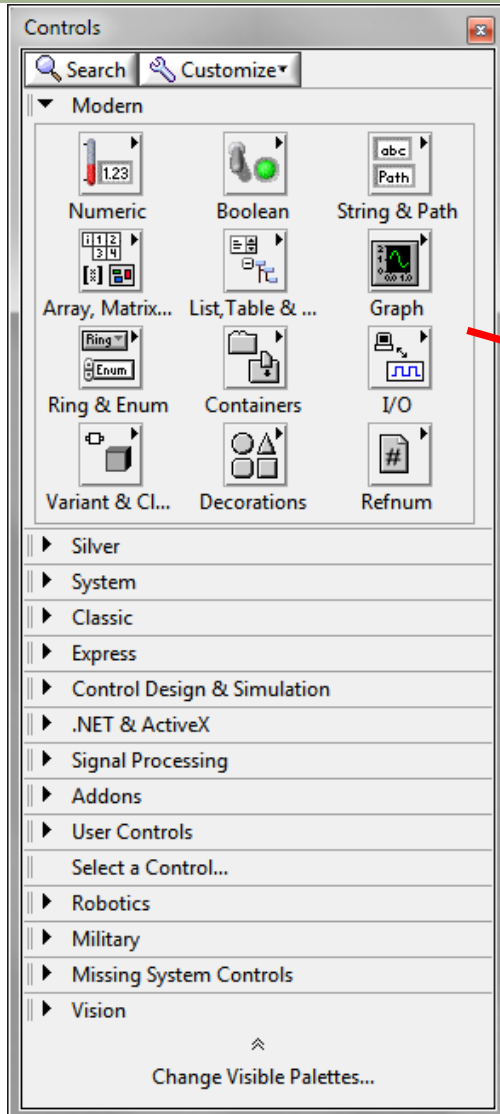
Buton Enter



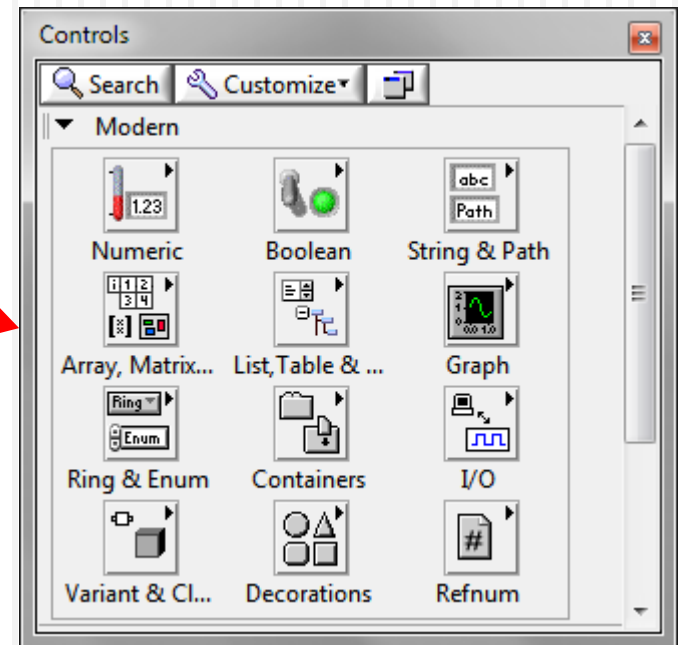
Necesar Debug

PANOU — Paleta de controale

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Controls Palette
Contine cele mai utilizate controale

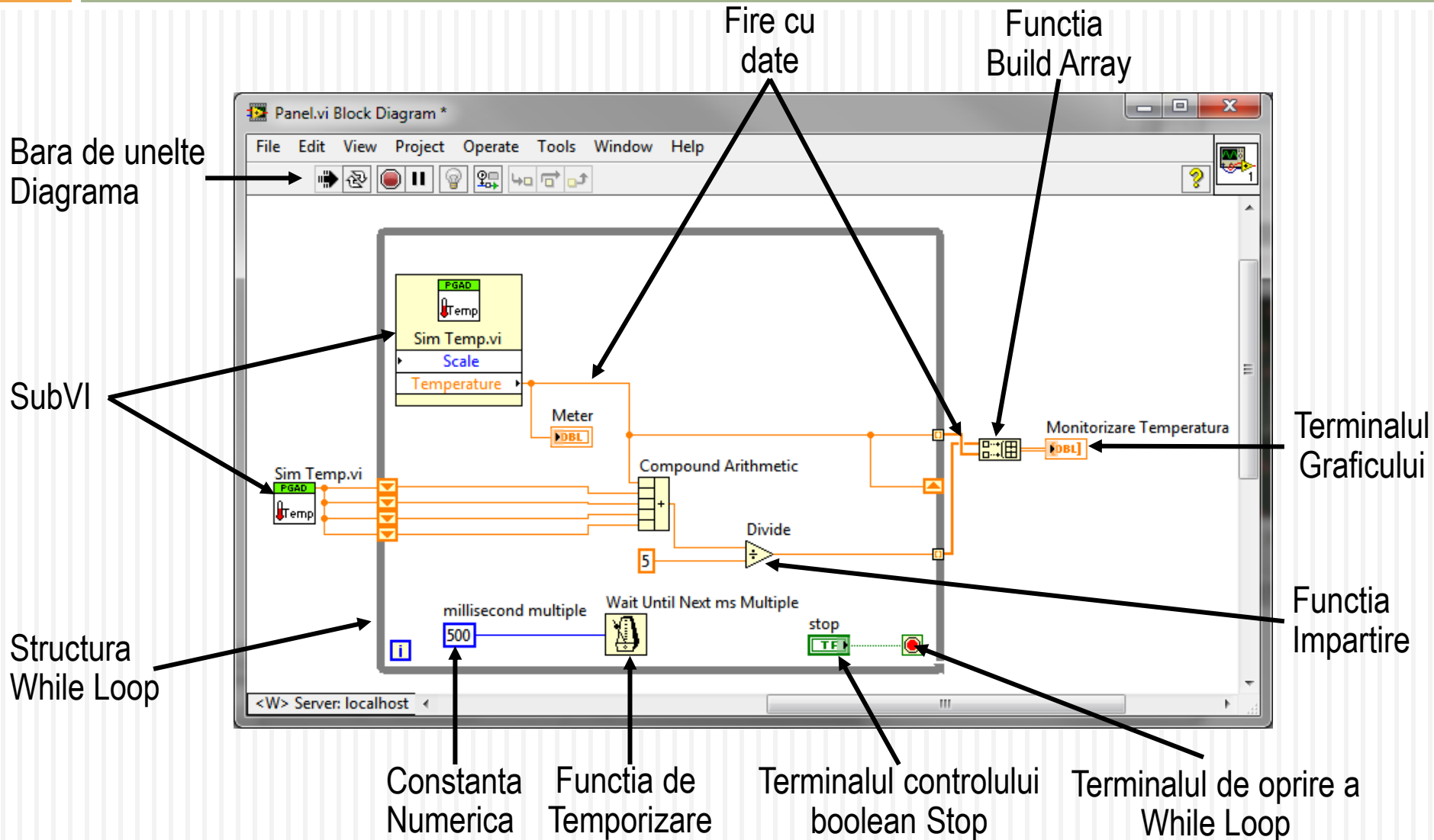


Paleta cu toate controalele Modern

Pentru a deschide paleta de controale:
View»Controls Palette

Fereastra DIAGRAMA => codul sursa

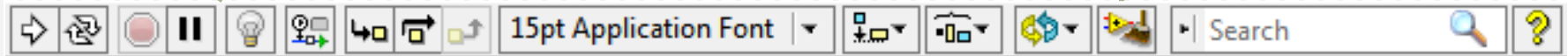
13



Bara de unelte in Diagrama

Butoane aditionale in diagrama

- Executie animata -EA
- Memorare valori in EA
- Step In
- Step Over
- Step Out
- Clean Up Diagram (selection)



Paleta de Unelte

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- LabVIEW poate selecta automat sau manual uneltele
- Disponibile in Panou si in Diagrama
- O unealta este de fapt un mod special de operare a cursorului mouse-ului
- Folosim aceste unelte sa lucram cu si sa modificam obiectele din Panou si Diagrama
- Pentru a deschide paleta de unelte:
View»Show Tools Palette



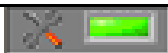





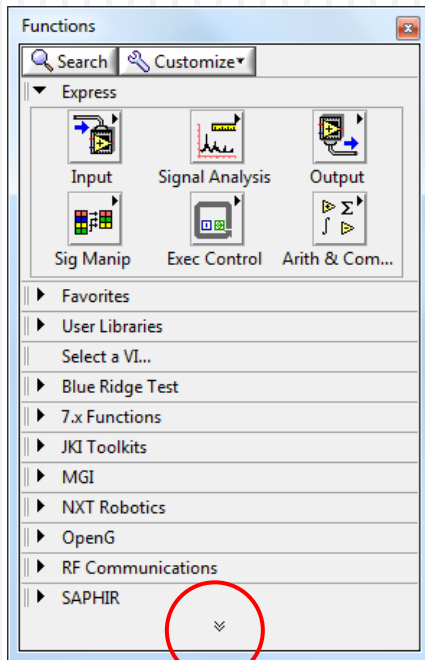
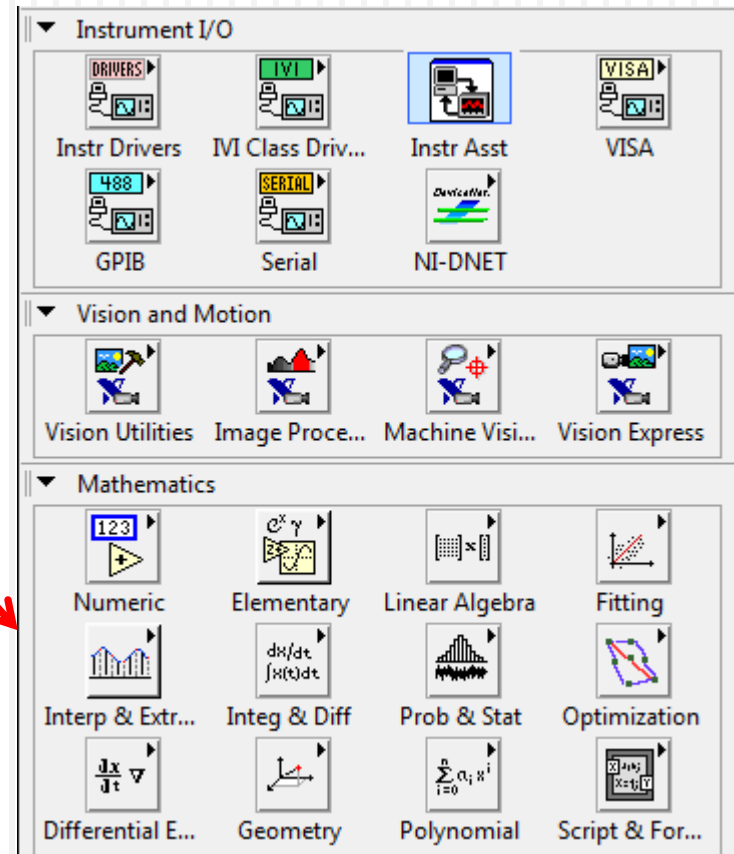
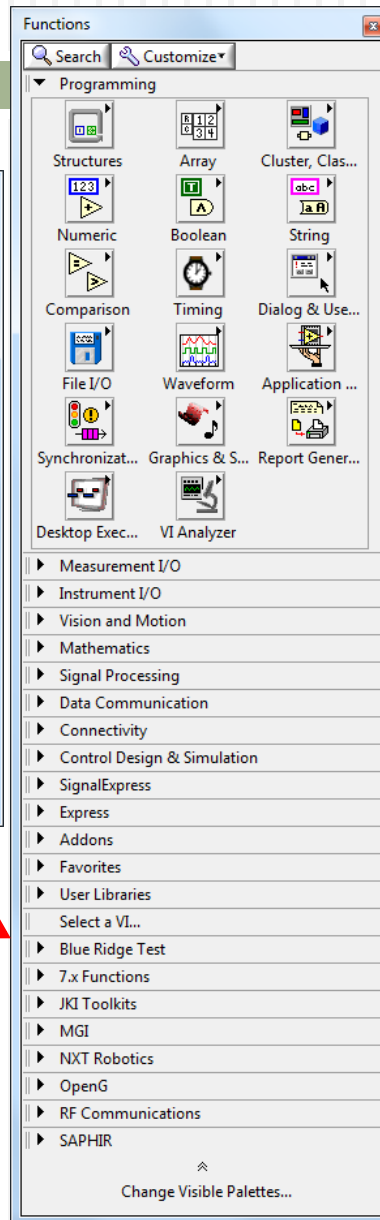
Simbol	Unealtă
	Selecția automată a uneltei
	Unealta de operare
	Unealta de editare, poziționare, redimensionare
	Unealta de editare text
	Unealta de conectare
	Unealta de inserare de probe

Diagrama — Paleta cu functii

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Functions Palette
Contine VI-uri Express
(VI interactive cu pagina
dialog configurabila) si
cele mai utilizate functii

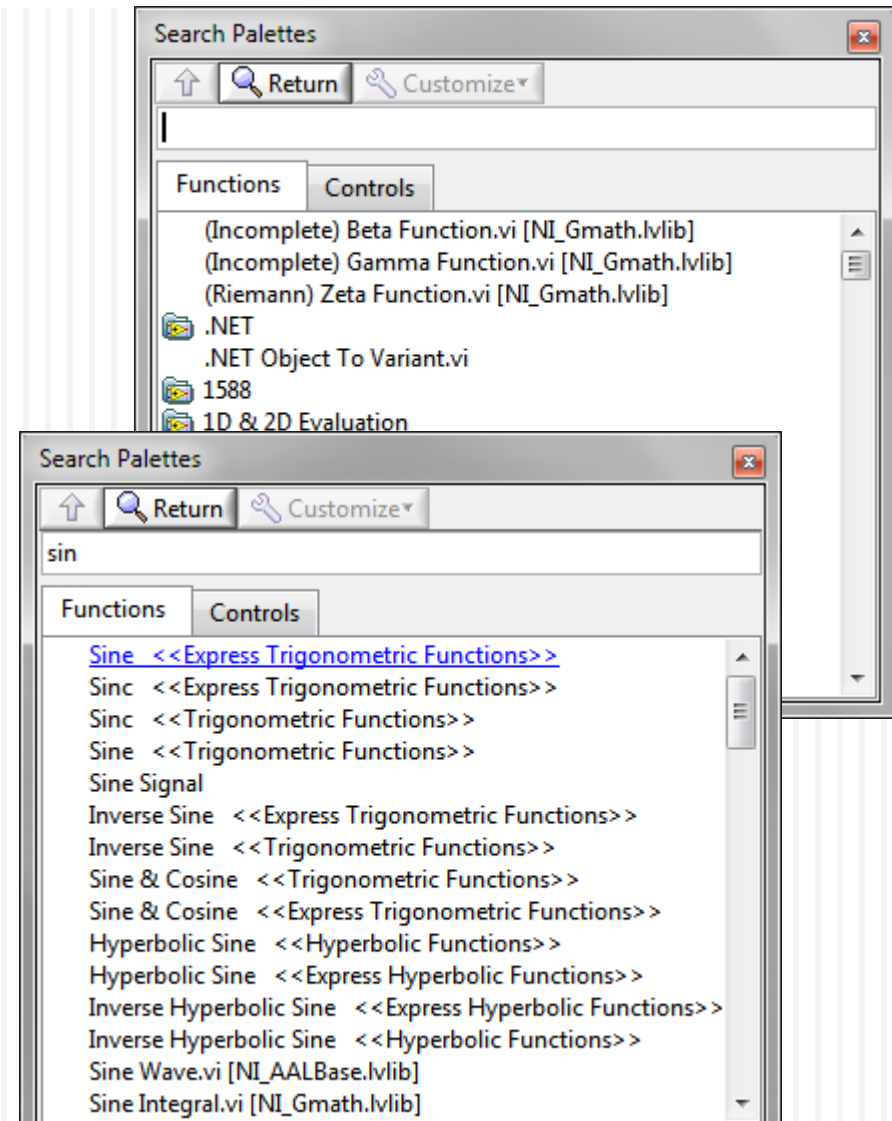


Diverse palete deschise

Cautarea Controalelor, VI-urilor si a Functiilor

17

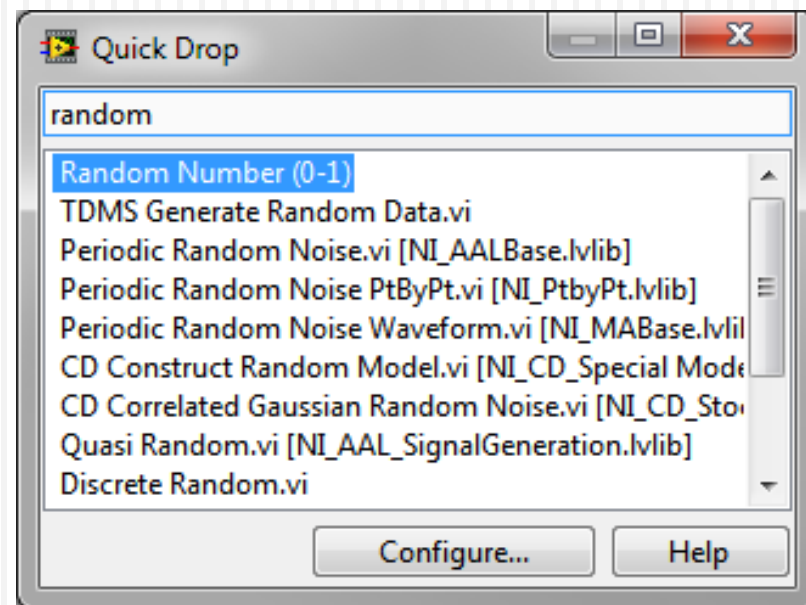
- Apasati butonul Search pentru a face cautari text in paleta (exemplu: sin)
- “Click and drag” un element din fereastra de cautare in “Diagrama” sau “dublu click” pe un item sa deschizi paleta parinte (superioara)



Cautarea cu Quick Drop

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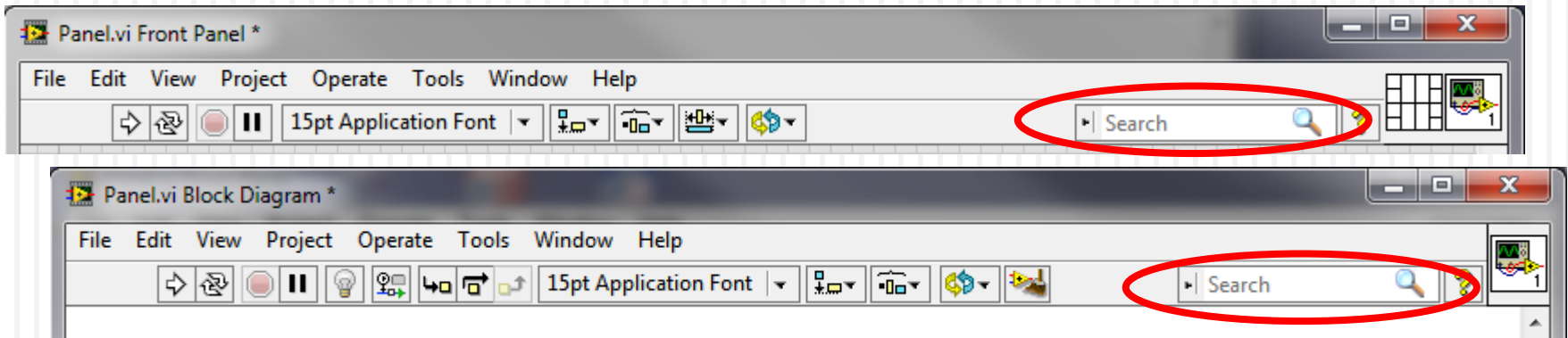
- Fereastra Quick Drop permite cautarea de:
 - ▣ Controale
 - ▣ Indicatoare
 - ▣ Functii
 - ▣ VI-uri
- Activarea ferestrei se face prin apasarea simultana a tastelor <Ctrl-Space> sau din meniul View»Quick Drop.



Search

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- In bara de unelte din Panel sau Diagrama
- Permite cautarea:
 - in palete
 - LabVIEW Help,
 - ni.com.

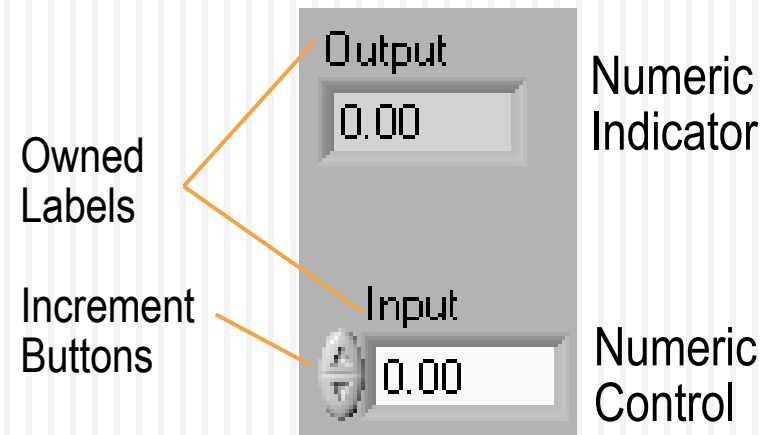
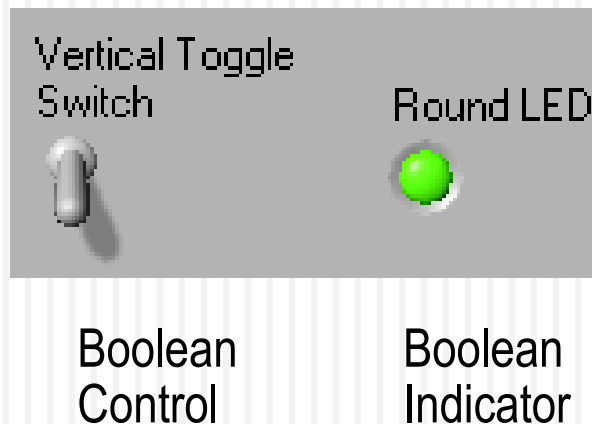


Creati Panoul Frontal al unui VI

20

Construiri panoul frontal cu:

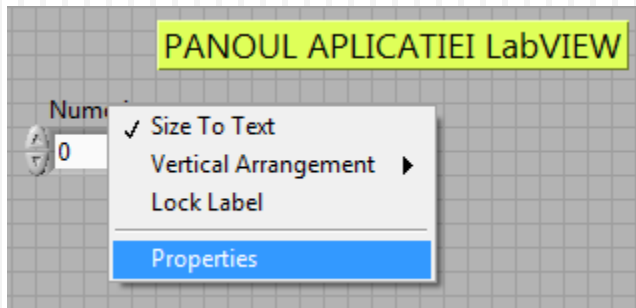
- Controale (intrari)
- Indicatoare (iesiri)



“Shortcut Menus” pentru obiecte din Panou

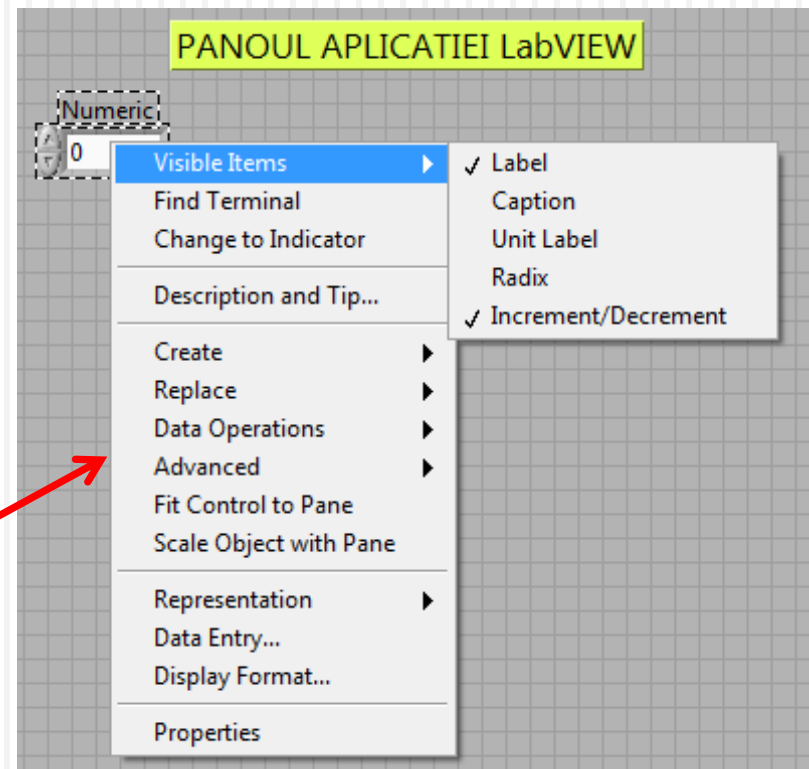
21

“Right-click” pe eticheta pentru ai accesa “shortcut menu”



Prin Right-click pe un obiect se acceseaza proprietatile obiectului

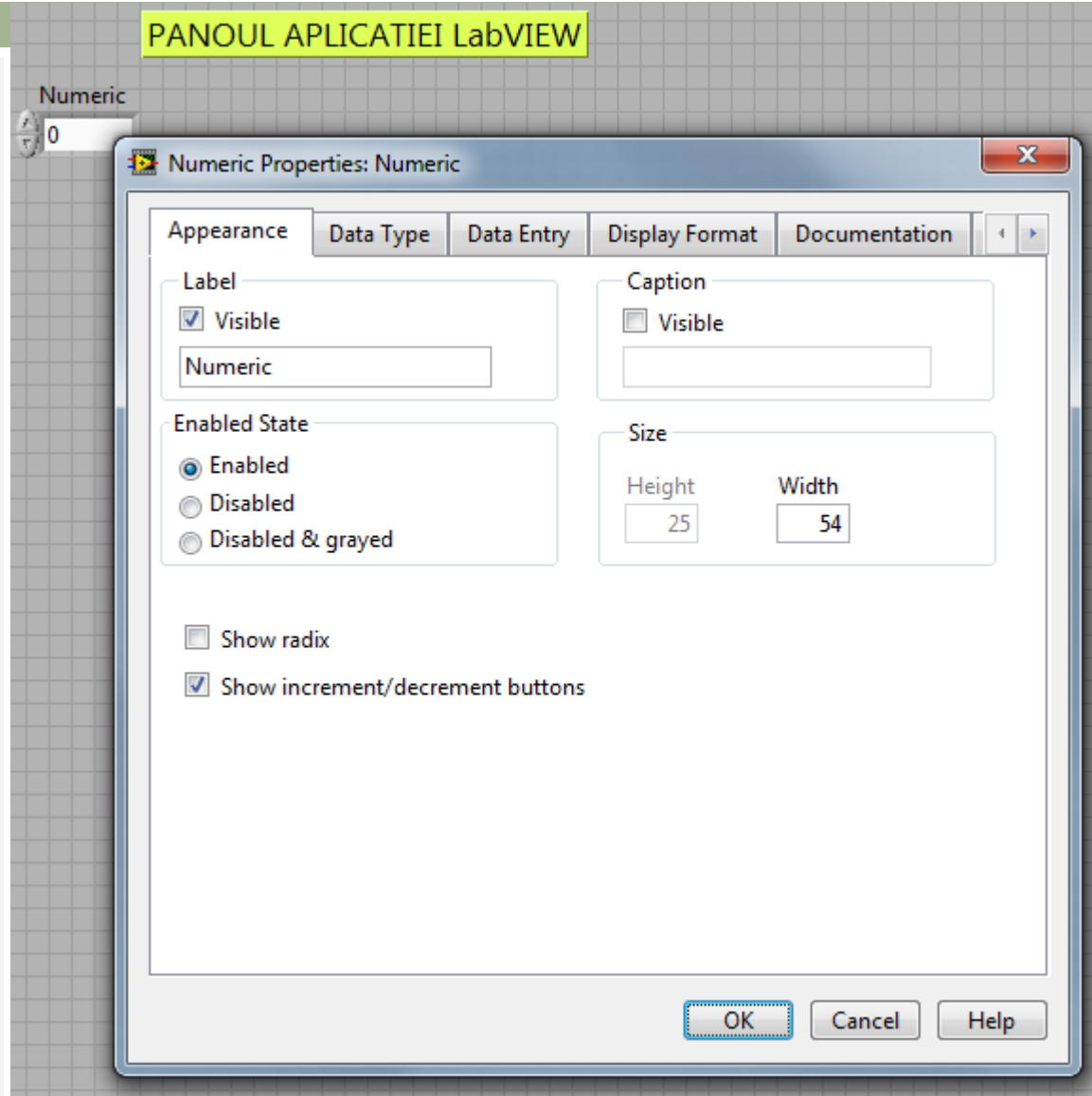
Right-click pe afisorul digital pentru ai accesa “shortcut menu”



Pagina de Proprietati

22

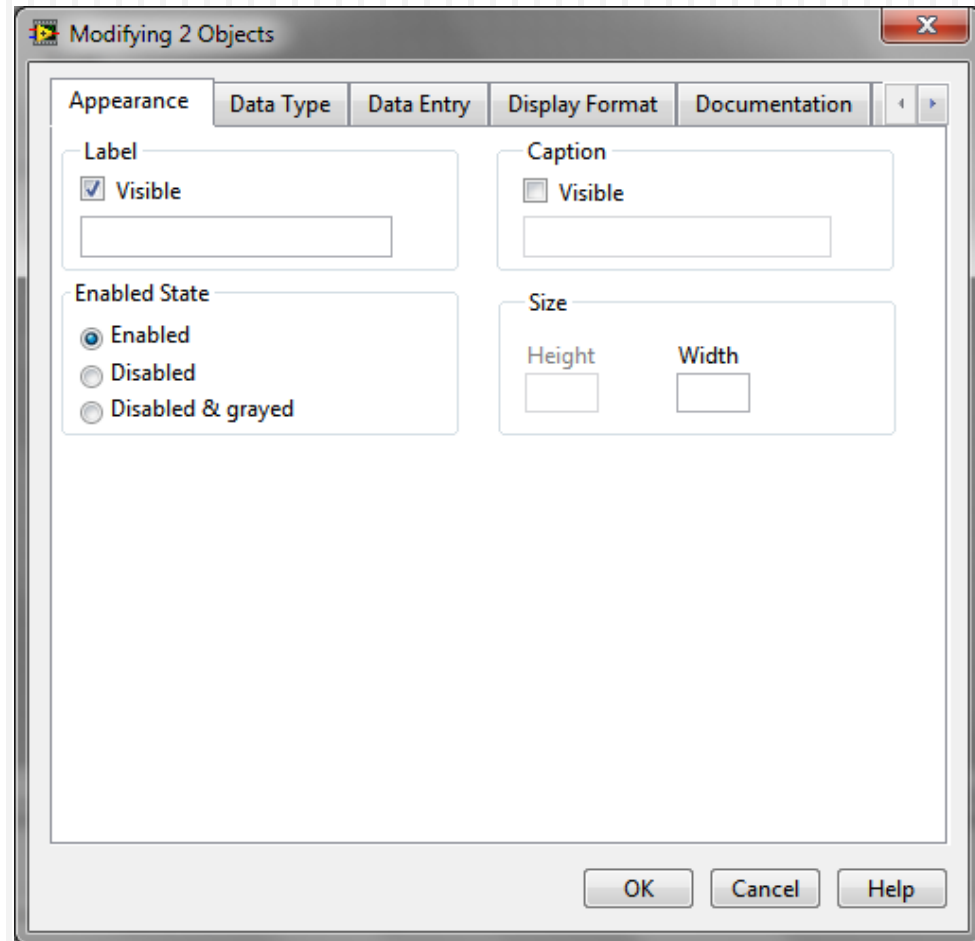
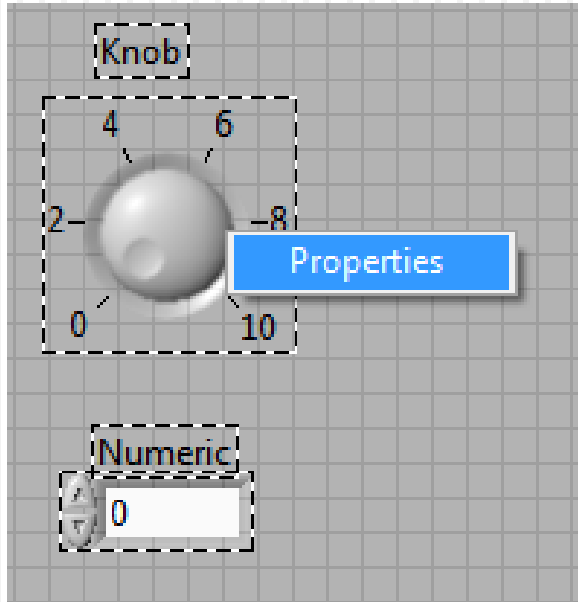
Right-click pe un control sau indicator din Panoul frontal si selectati **Properties** din menu-ul “shortcut” pentru a ajunge la panoul de dialog al proprietatilor acelui obiect.



Pagina de Proprietati

23

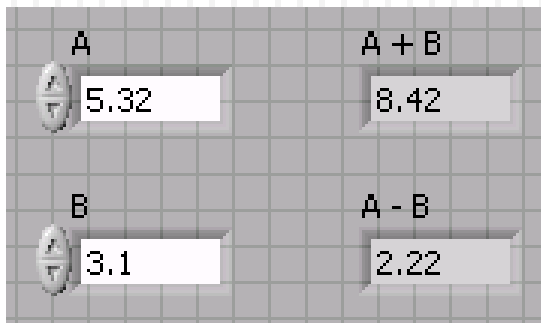
Selectie multipla pentru configurarea proprietatilor comune



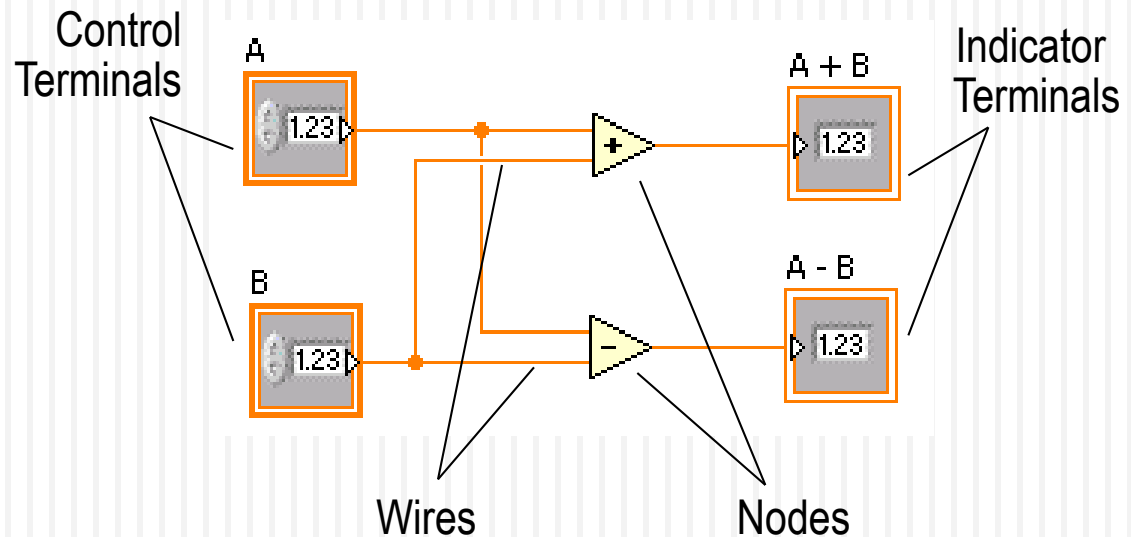
Crearea unei DIAGRAME (program)

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Front Panel








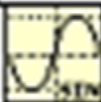


Block Diagram



Realizati diagrama cat mai ordonat posibil:

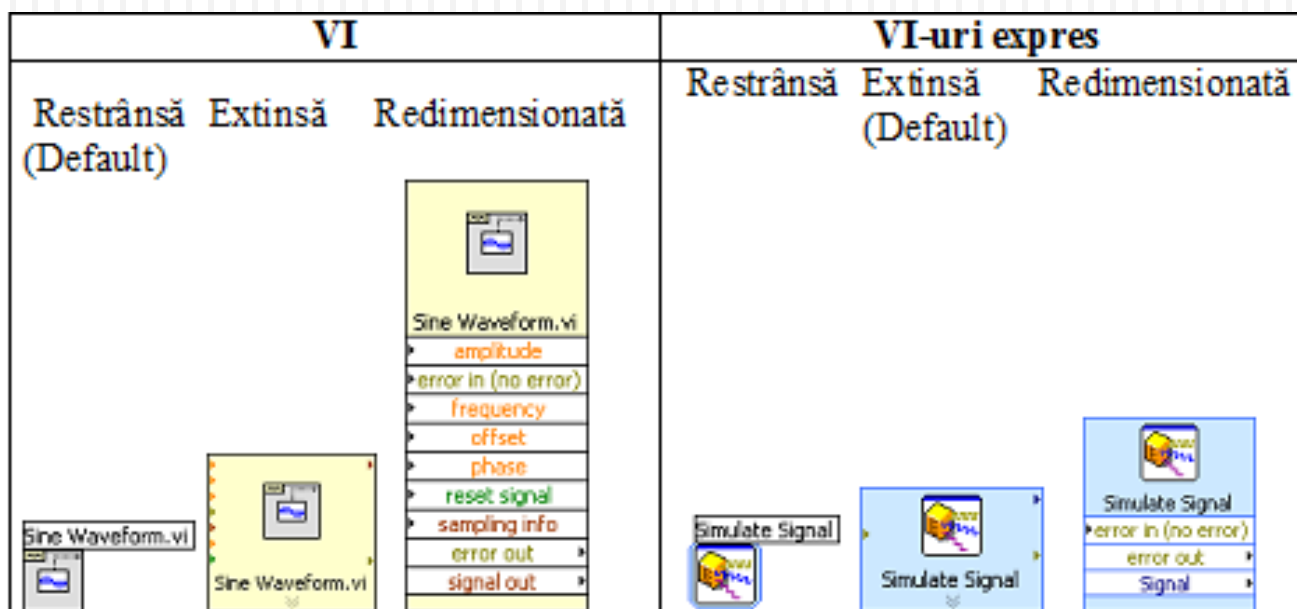
- **controalele in dreapta indicatoarele in stanga,**
- **cat mai putine intersectii ale firelor,...**

Noduri

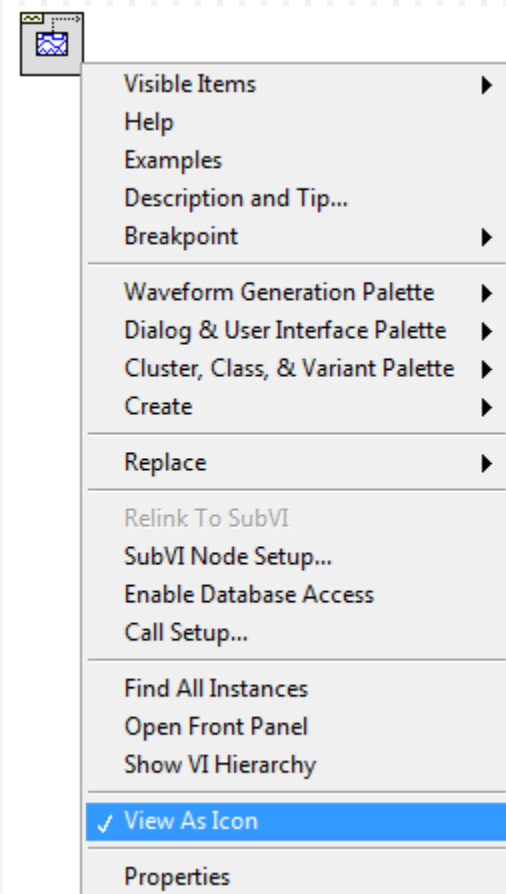
Noduri		Descriere	
Controale	Indicatoare		Noduri asociate obiectelor din panou
		Dupa tipul de terminal	
		Dupa tipul de date	
		Noduri asociate functiilor	
		Noduri asociate subVI-urilor	
		Noduri asociate VI-urilor expess	

Noduri

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**Click dreapta
pe nod**



Cablare in Diagrama (realizarea programului)

27

Tipul de fir	Scalar	Vector 1D	Vector 2D	Culoare
Numeric				Portocaliu (virgulă mobilă), Albastru (întreg)
Boolean				Verde
Alfanumeric				Roz
Dinamic				Albastru închis

Cablare nereusita –

linie neagra punctata cu un x rosu

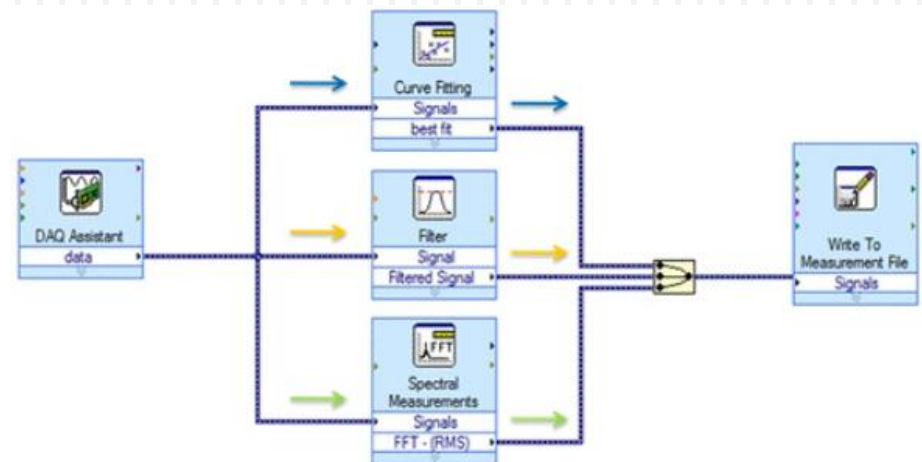
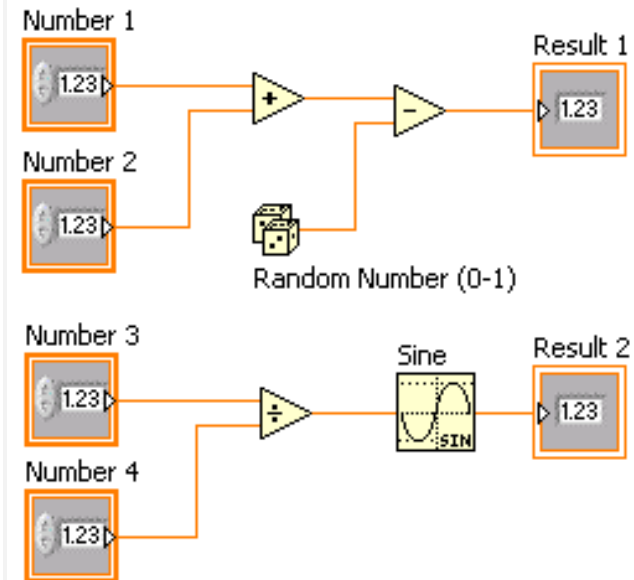
(sunt marcate prin sageti tipurile de date)



Programare cu flux de date

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- Digramele se executa in functie de fluxul de date; schema bloc nu se executa de la stinga la dreapta
- Nodul se executa atunci cind datele sunt prezente la toate terminalele de intrare
- La terminare nodurile livreaza date la toate terminalele de iesire

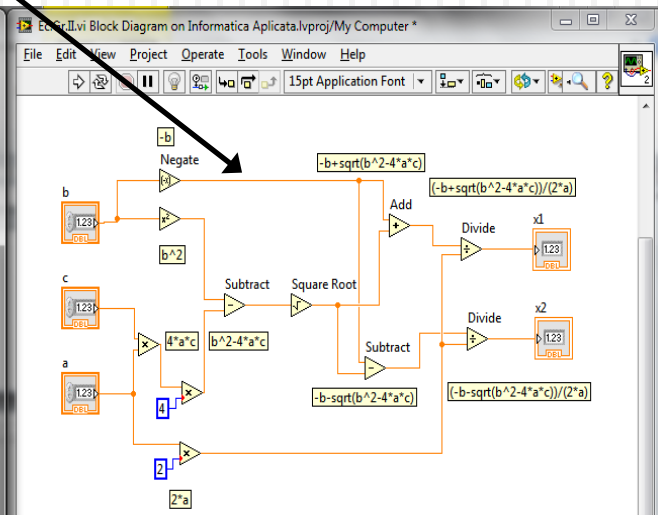
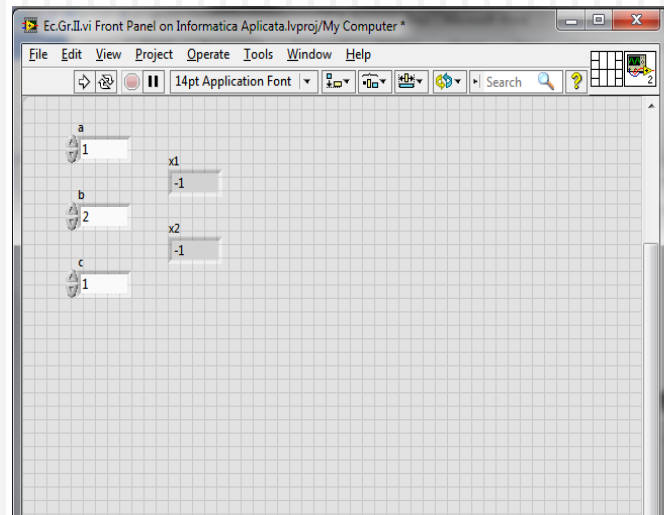
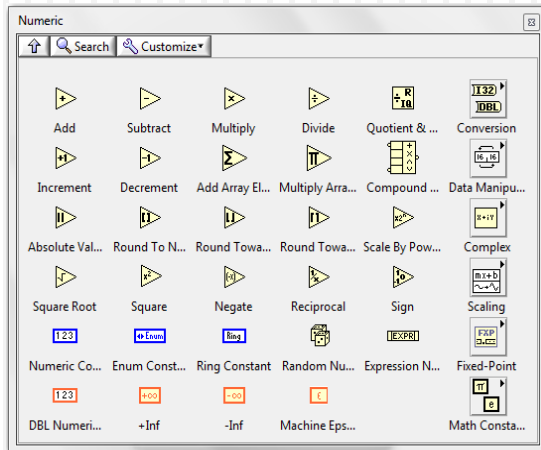


Ex. Primele aplicatii

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□ Rezolvarea ecuatiei de gradul II

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



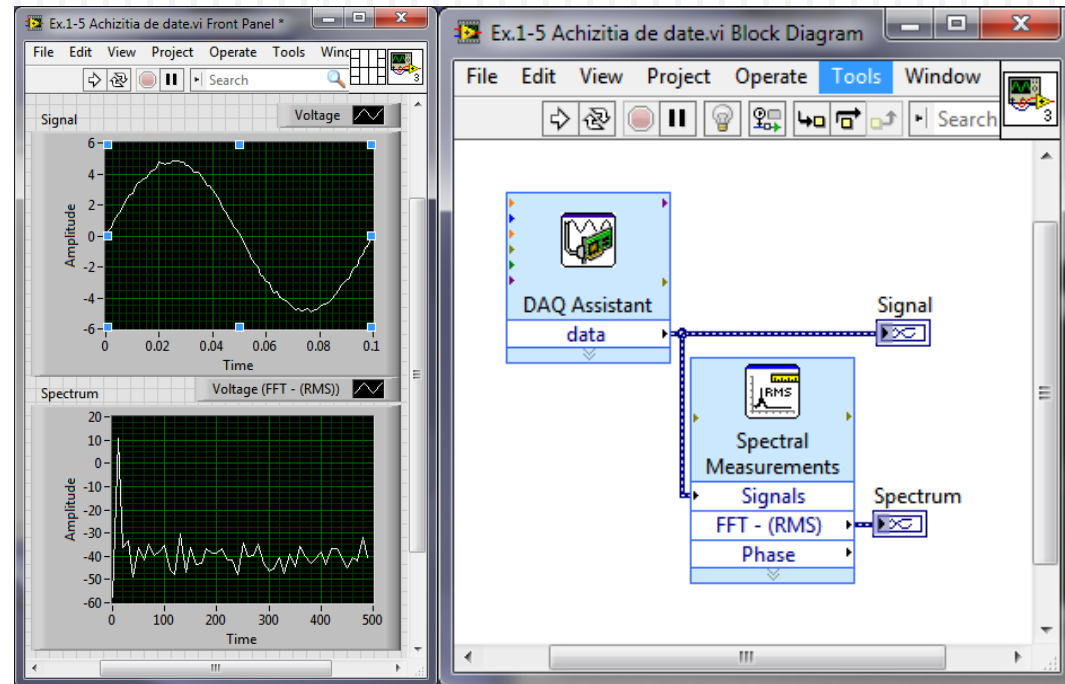
Ex. Masurarea semnalelor

30



Exercitiu

- Realizarea unei aplicatii care permite achizitia si prelucrarea datelor in LabVIEW





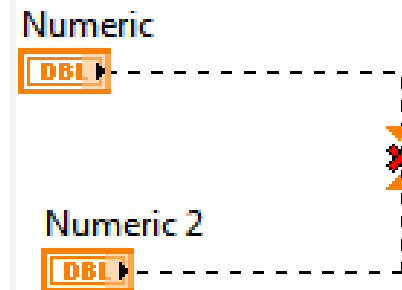
**Depanarea aplicatiilor (debugging) si
elemente de programare.**

Tehnologii de depanare “Debugging”

32

□ Erori de sintaxa

- Conectari intre tipuri de date diferite
- Conectarea a doua intrari
- Nedefinirea conditiei de oprire a buclor
- Neconectarea intrarilor obligatorii ale nodurilor
- ...

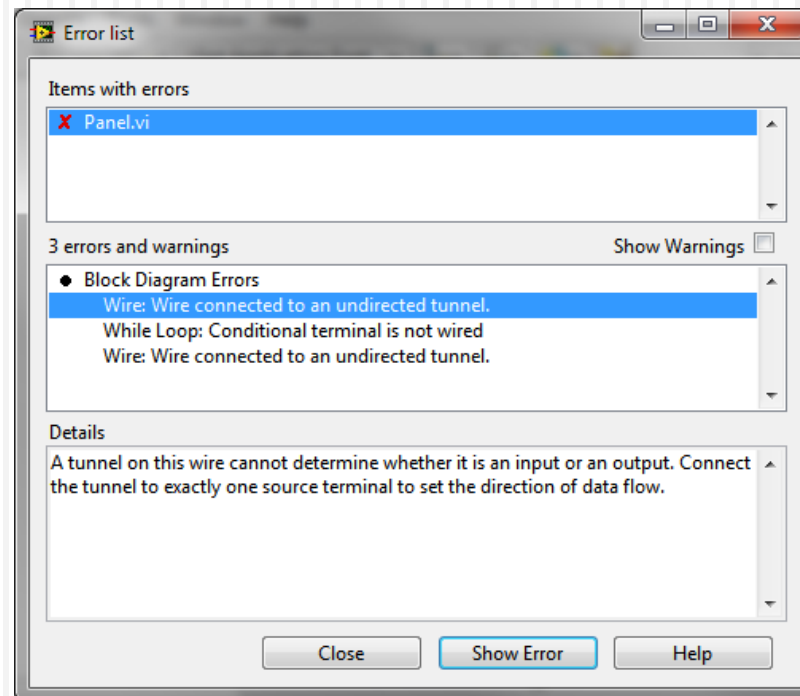


Tehnologii de depanare “Debugging”

33

□ Erori de sintaxa


- Dati click pe sageata “intrerupta” de rulare simpla.
- Apare o fereastră care va prezenta erorile de programare



Tehnologii de depanare “Debugging”

34

□ **Erori de programare**

- Aplicatia este functionala - , dar se obtin rezultate neasteptate
 - Date de intrare incorecte introduse
 - Conectarea incorecta a nodurilor
 - Reprezentarea numerica a variabilelor
 - Ordinea de executie a nodurilor

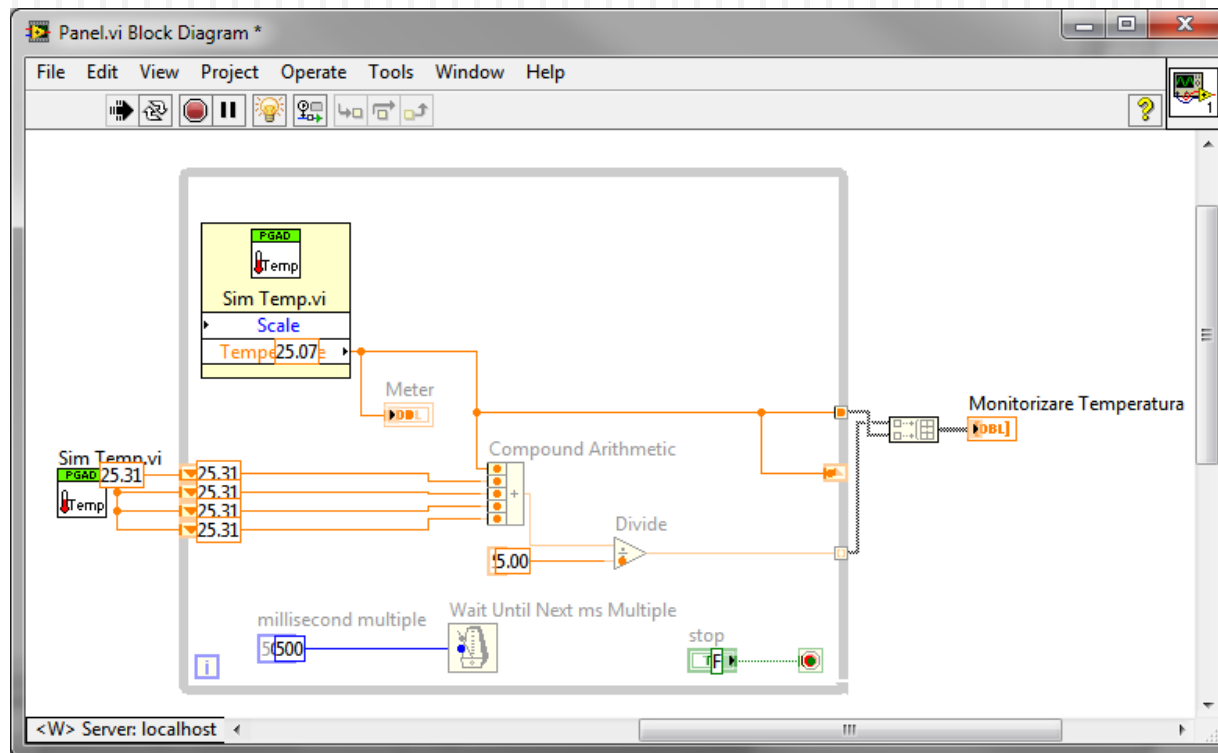
Tehnologii de depanare “Debugging”

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Highlight Execution



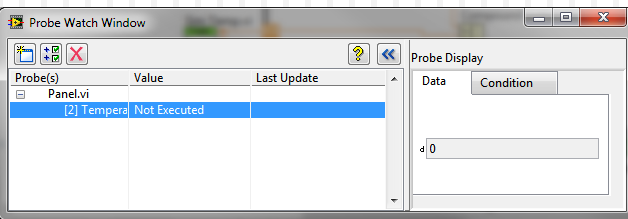
Dati Click pe butonul de Executie animata; se vizualizeaza animat fluxul de date. Se vizualizeaza valorile care trec prin fire



Tehnologii de depanare “Debugging”

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Proba



Right-click pe un fir si selectionati “PROBE” si se vor afisa datele care ajung in acel punct

Memorarea valorilor pe fire

prin apasarea butonului  se memoreza valorile pe fire a.i. vor fi disponibile si dupa executia aplicatiei

Probe conditionale

Custom Probe

Breakpoint

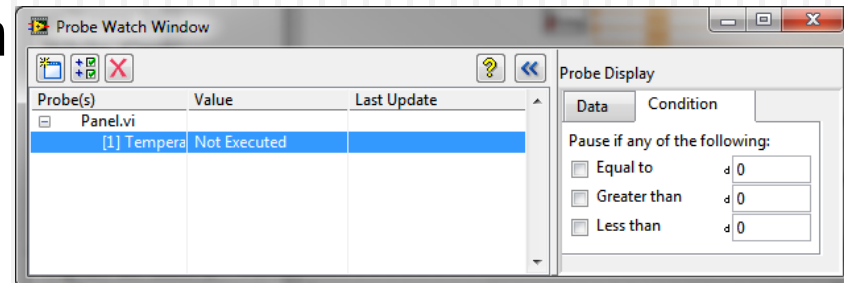
Description and Tip...

Conditional Double Probe

Generic Probe

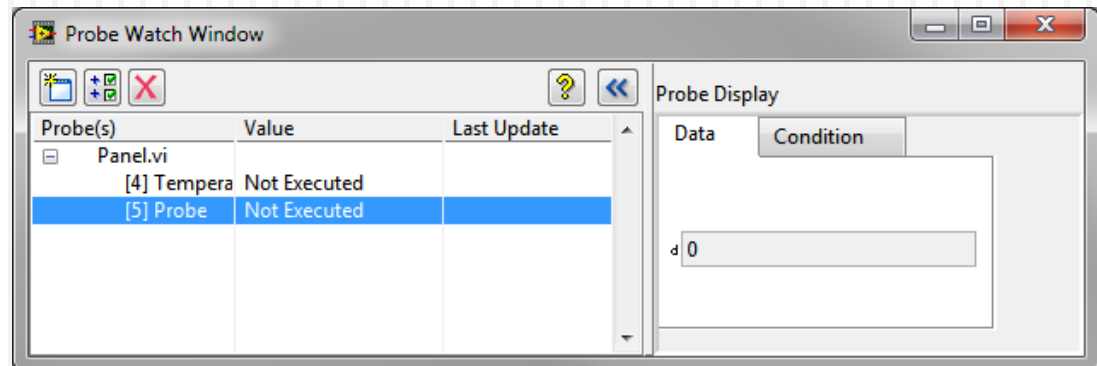
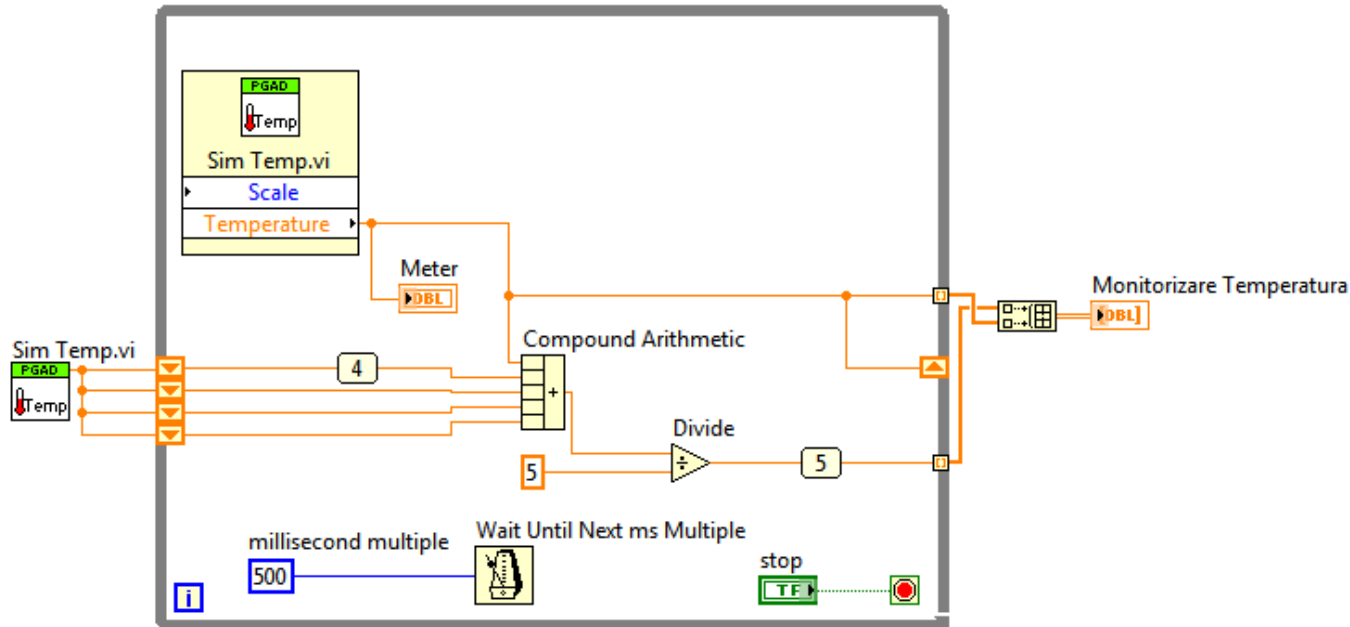
Controls

New...



Tehnologii de depanare “Debugging”

37

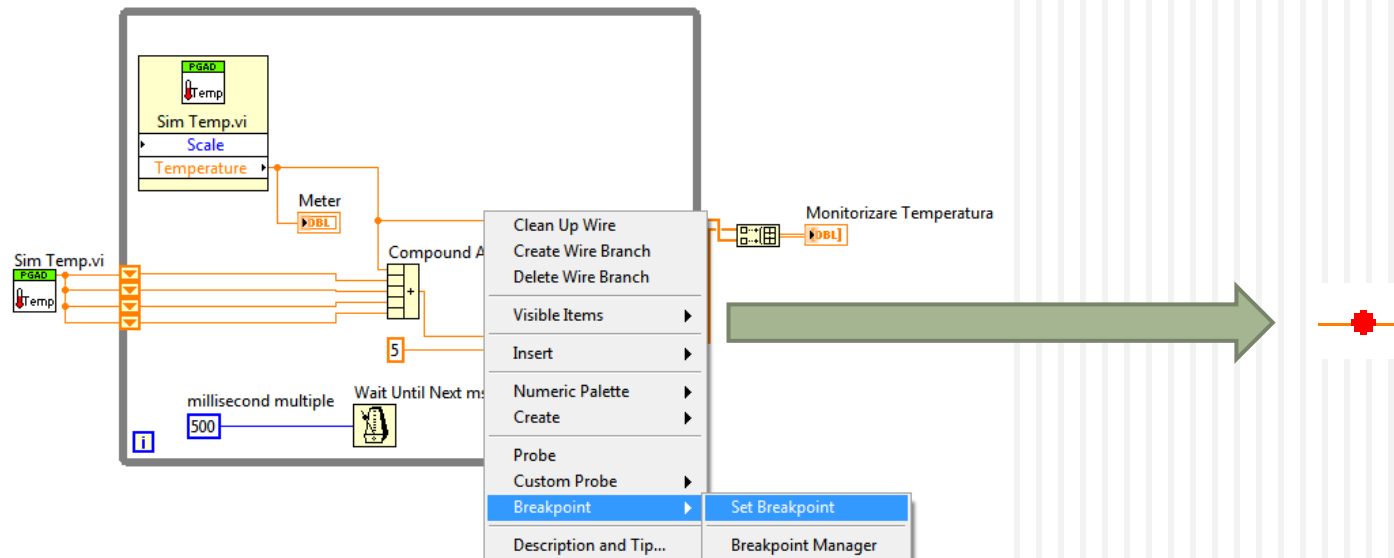


Tehnologii de depanare “Debugging”

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Breakpoints

Right-click pe un fir si selectionati “Set Breakpoint”;
se face o pauza de executie la acest punct de oprire



Tehnologii de depanare “Debugging”

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Butoanele Step Into, Over, si Out pentru “Single Stepping”



Click pe butonul **Step Into** pentru a enabla “single stepping”
Pornit procesul “Single Stepping”, butonul ruleaza nodurile



Click pe butonul **Step Over** pentru a enabla “single stepping”
sau pentru a trece peste noduri



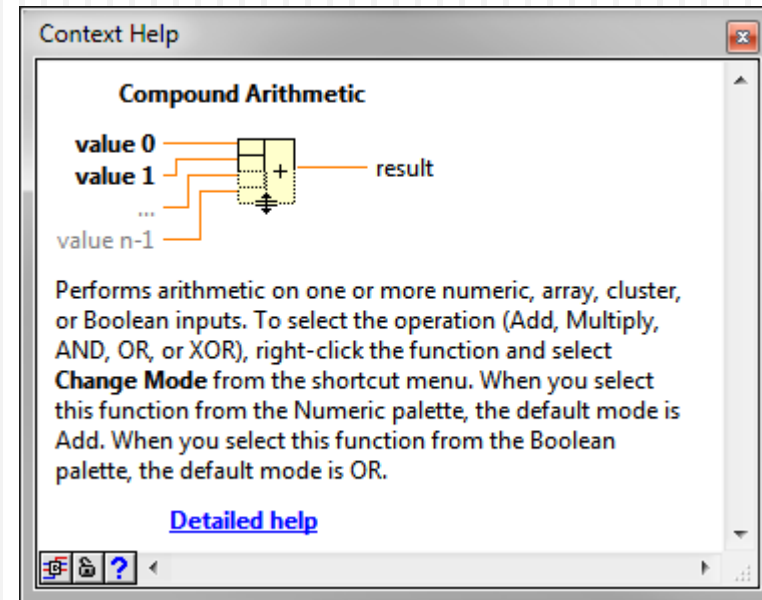
Click pe butonul **Step Out** pentru a iesi din noduri

Help in LabVIEW

- Orice limbaj de programare este însoțit cu o documentație – Help
- În LabVIEW există
 - ▣ Help-ul interactiv – Context Help
 - ▣ Help-ul general – LabVIEW Help
 - ▣ Biblioteca de exemple functionale – NI Example Finder
 - ▣ Comunitatea ni.com

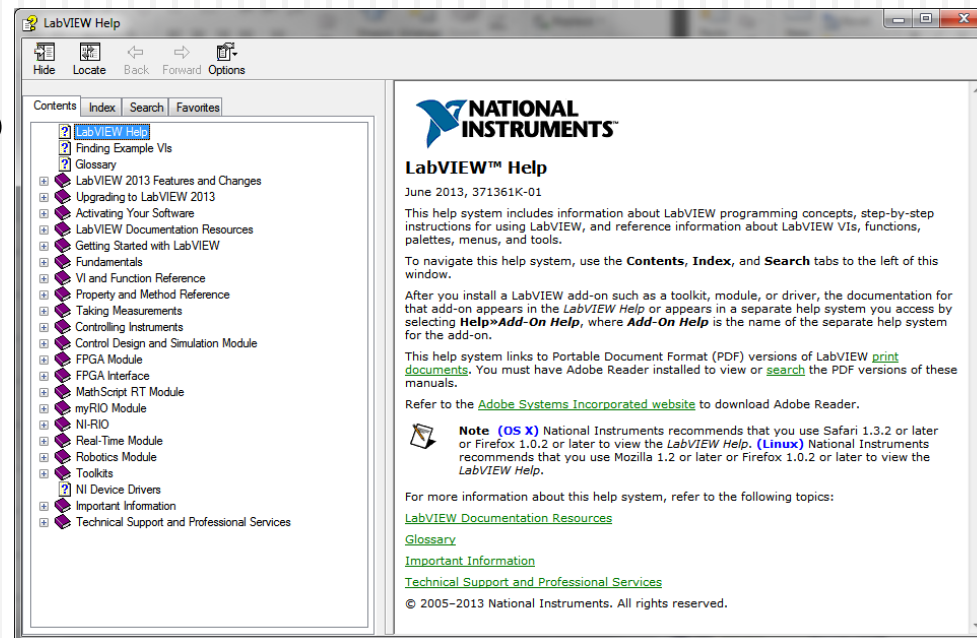
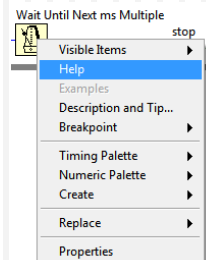
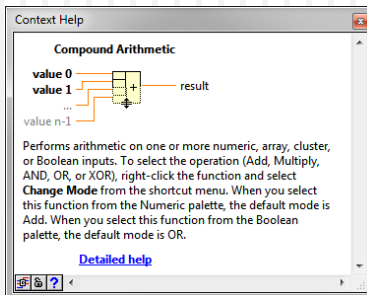
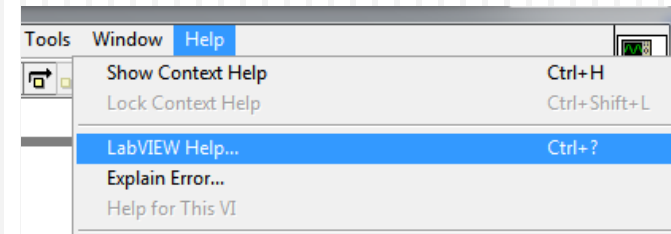
Context Help

- Prezinta informatii de baza pentru nodul peste care se trece cu mouse-ul
- Activare/dezactivare:
 - **Help»Show Context Help** sau
 - Apasarea tastelor **Ctrl-H** sau
 - Apasarea butonului **Show Context Help Window** din bara de unelte



LabVIEW Help

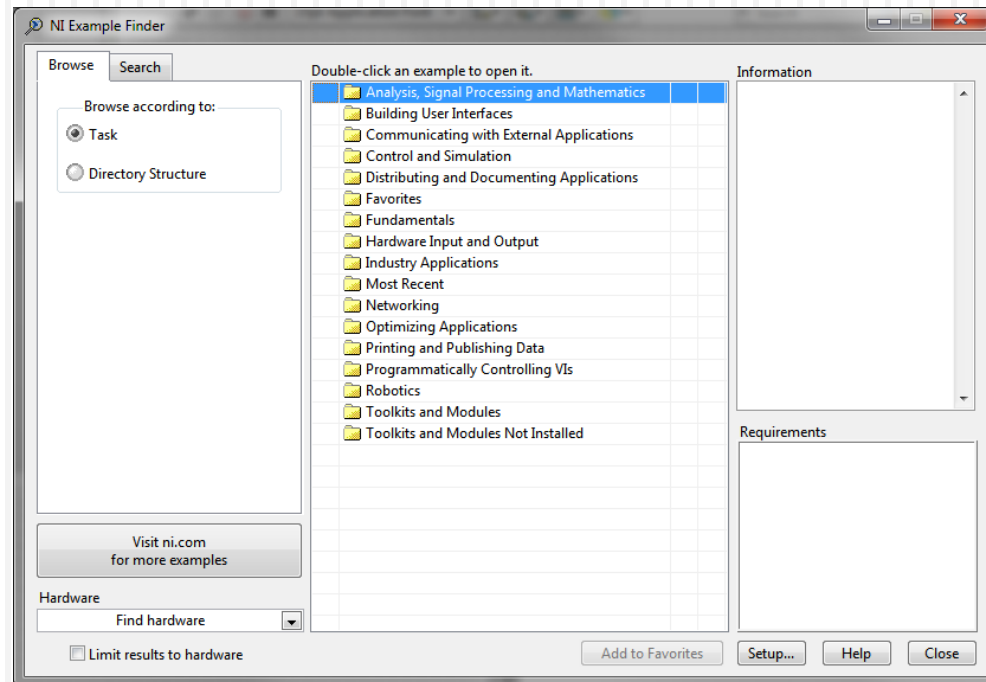
- Intreaga documentatie ce insoteste LabVIEW
- Deschidere prin optiunile:
 - **Help»LabVIEW Help**
 - **Detailed help** din fereastra de **Context Help**
 - Right-click pe nod si alegerea optiunii **Help** din meniul deschis
 - Tastele **Ctrl+?**



NI Example Finder

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- Permite gasirea exemplelor functionale instalate pe PC structurare pe categorii sau prin cautare – Search
- Activare
 - **Help»Find Examples...**



Curs 3 – Partea 1

Realizarea aplicatiilor

Proiectarea Aplicatiilor

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- Interfata Utilizator trebuie sa fie:
 - ▣ Prietenoasa
 - ▣ Usor de utilizat
 - ▣ ...
 - ▣ => Front Panel Design
- Diagrama
 - ▣ Bine structurata
 - ▣ Documentat codul
 - ▣ => usor de depanat, modificat sau actualizat
 - ▣ Reutilizarea codului

Front Panel Design






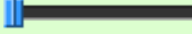



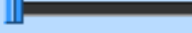

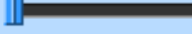




□ Ce este gresit?



□ Cam multe culori...

Redesign

- Putina culoare (client-utilizator)
- Utilizare decoratii


	Status	Output	Error	Tuning	Reset
Dryer 1		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Dryer 2		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Molder 3		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Molder 4		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Shaper 5		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Shaper 6		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Finisher 7		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>
Finisher 8		<input type="text" value="0.00"/>	<input type="text" value="0.00"/>		<input type="button" value="RESET"/>

0 5 10

Operator Name

Items Processed

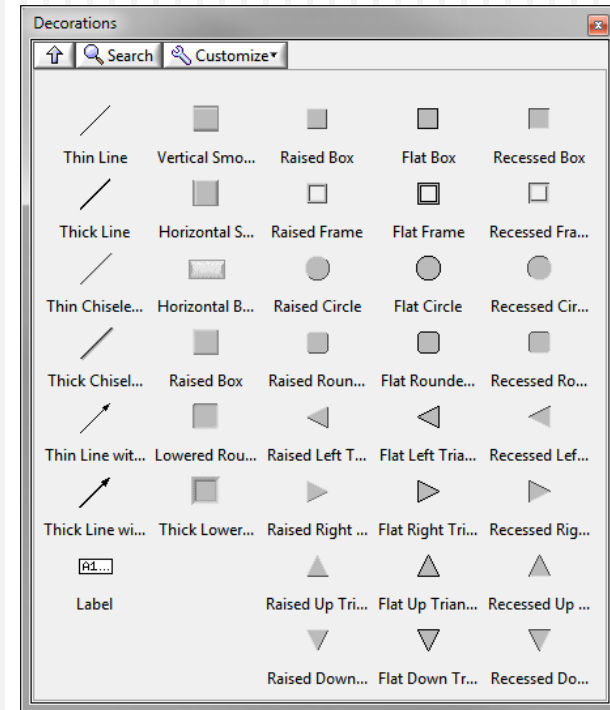
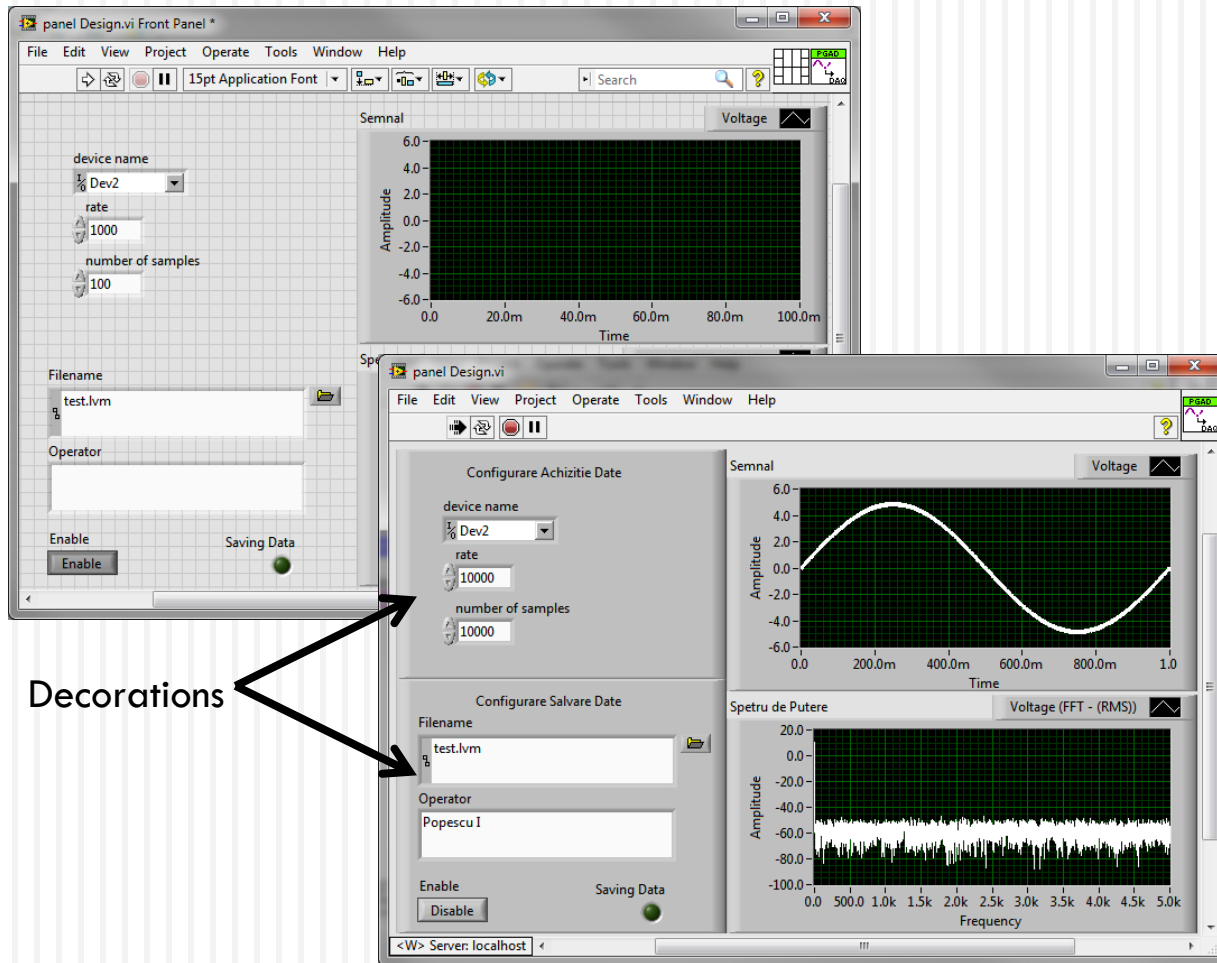
Happy G Consulting



Front Panel Design

48

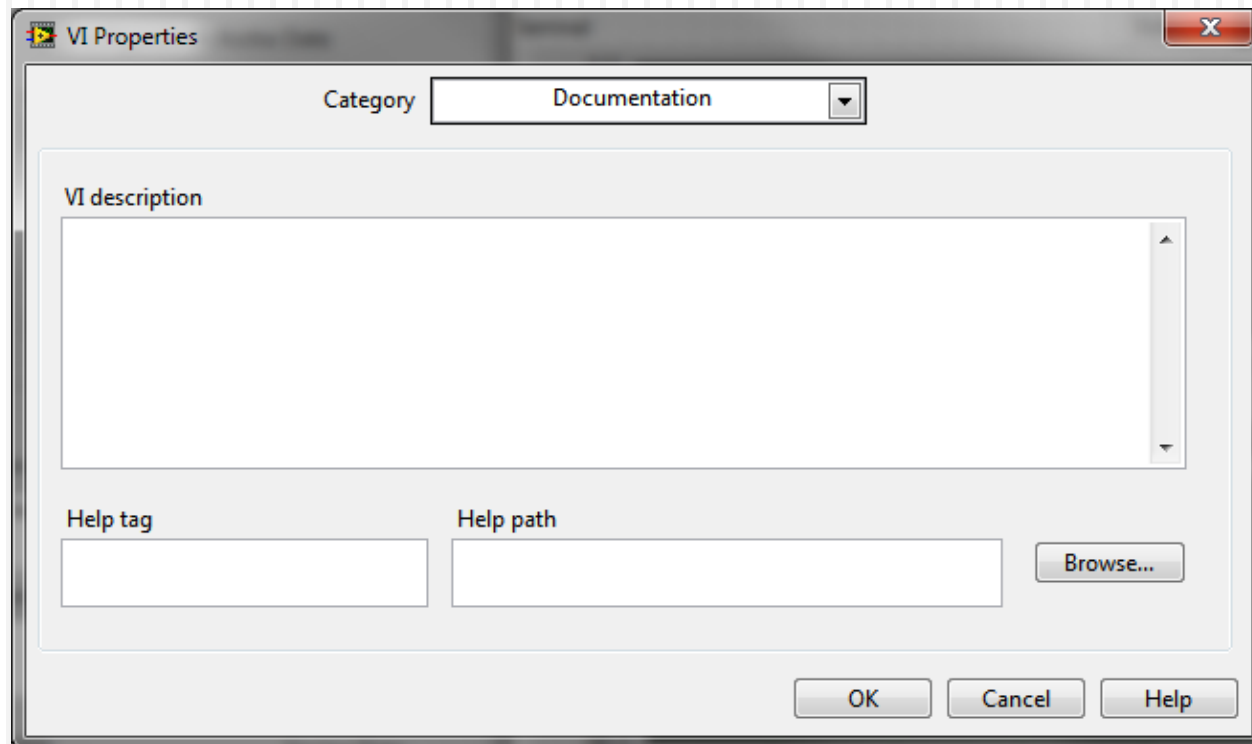
- Grupare obiecte pe domenii – utilizare paleta



Documentarea aplicatiei

49

- Documentarea panoului
 - ▣ Descriere aplicatie VI Properties (File>>VI Prop.)

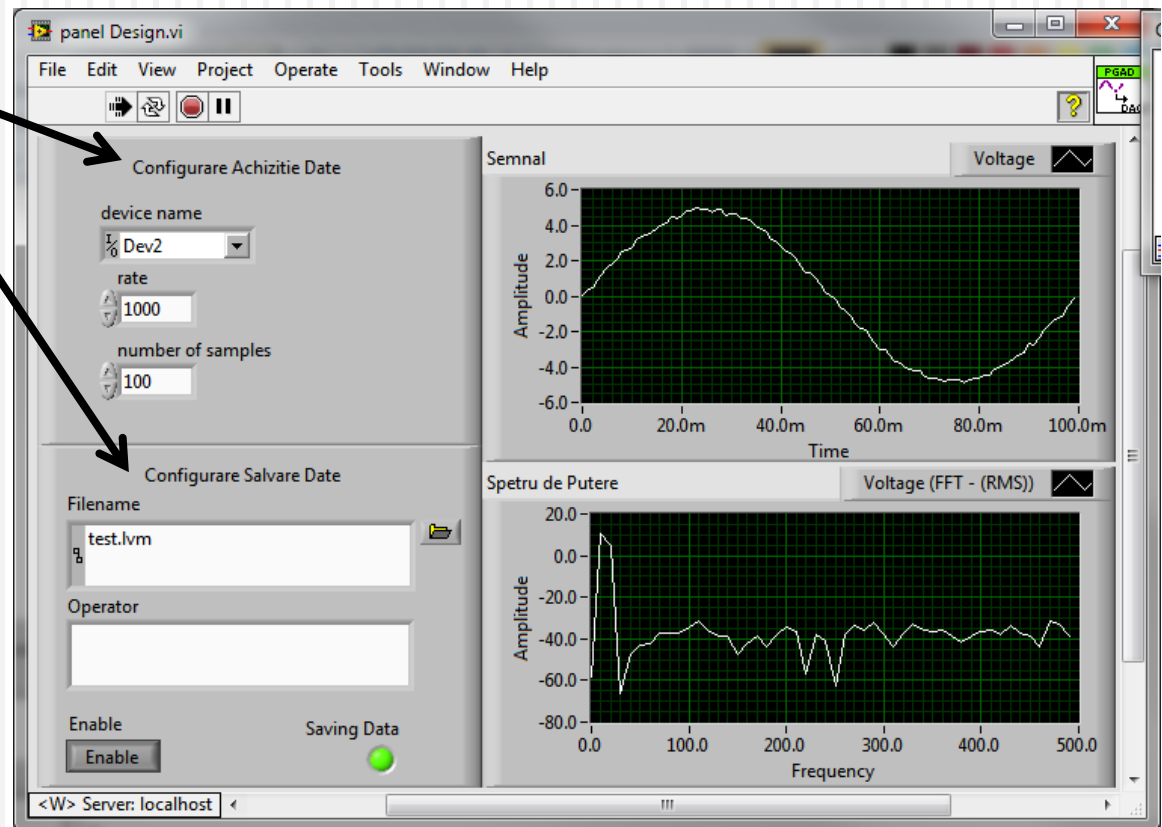




Documentarea aplicatiei

51

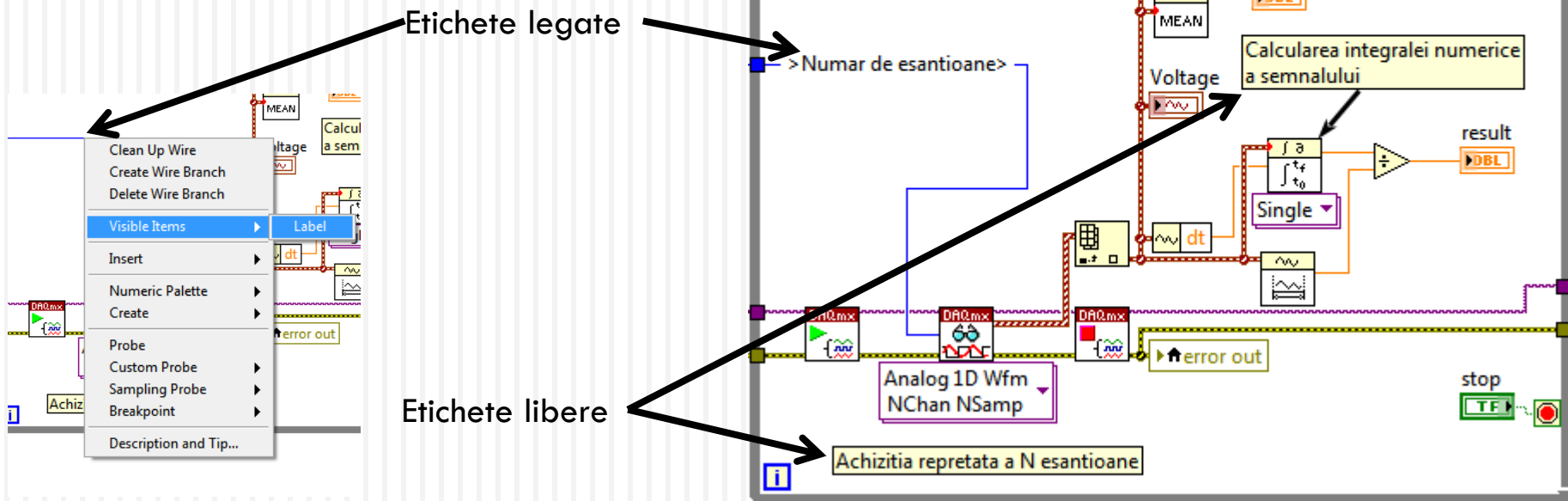
- Documentarea panoului
 - ▣ Etichete obiecte (**suggestive**)
 - ▣ Etichete libere



Documentarea aplicatiei

52

- Documentarea diagramei
 - Comentarii – etichete libere – descriere algoritmi, explicare zone de cod
 - Descriere datelor asociate firelor





Programarea modulara

Modularizare si incapsulare

54

- diagrame mari, complexe trebuie modularizate
 - Portiuni de cod dedicate
 - Codurii apelate de mai multe
 - =>
 - se realiza module incapsulate care sa poata fi aplelate de câte ori este nevoie si unde este nevoie (asemanator cu programarea clasica bazata pe proceduri).

Modularizare si incapsulare

55

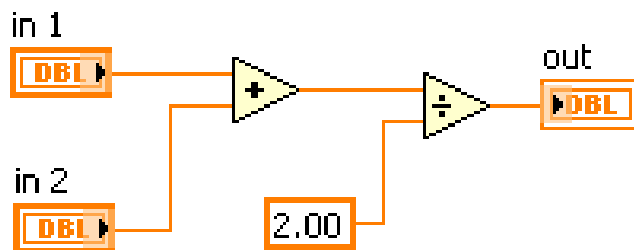
Function Pseudo Code

```
function average (in1,  
    in2, out)  
{  
out = (in1 + in2)/2.0;  
}
```

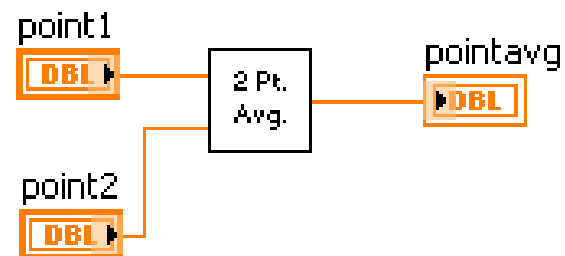
Calling Program Pseudo Code

```
main  
{  
    average (point1, point2,  
        pointavg)  
}
```

SubVI Block Diagram



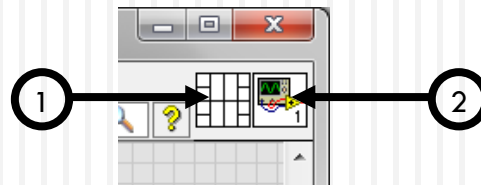
Calling VI Block Diagram



Modularizare si incapsulare

56

- Fiecare VI realizat sub LabVIEW poate fi utilizat ca un subVI intr-o alta aplicatie.
- Pentru a utiliza un VI ca subVI trebuie incapsulat intr-un icon si realizat conectorul sau.
- Conectorul presupune definirea intrarilor si iesirilor din subVI.
- La deschiderea unui VI, in partea dreapta sus exista iconul predefinit si conectorul langa el.

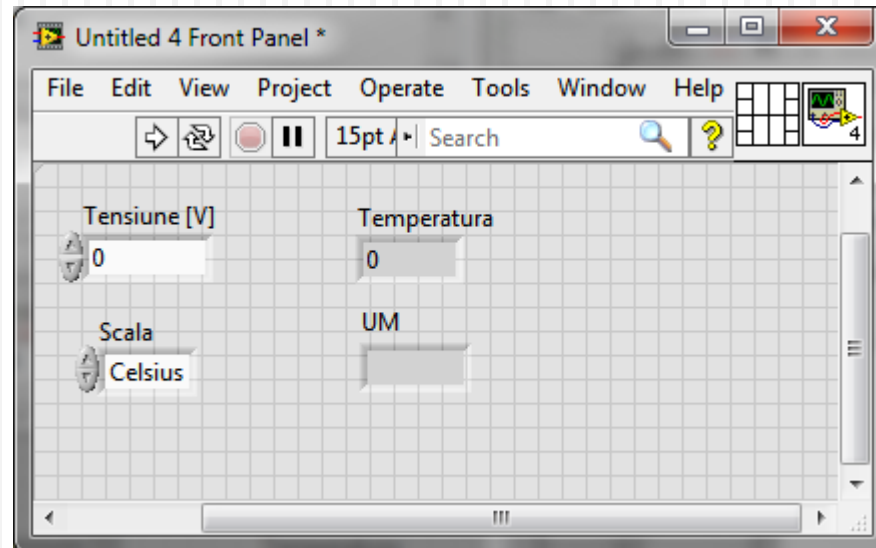


1. Conector; 2. Icon

Exemplu de SubVI

57

- Un VI in interiorul unui alt VI se numeste subVI
- Dupa ce am facut Panoul si respectiv Diagrama unei aplicatii VI, pentru a utiliza acest VI ca un subVI, trebuie sa realizam Iconul lui si un Conector (connector pane),

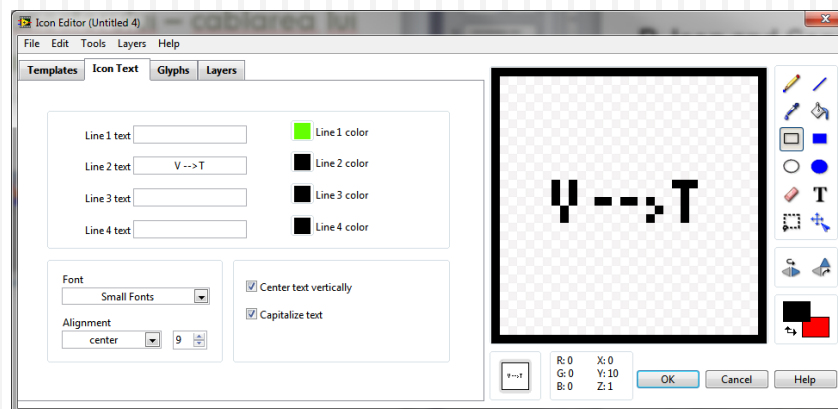
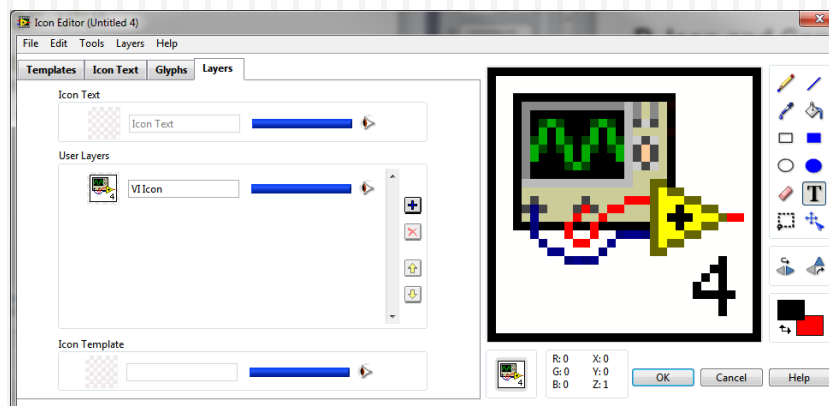
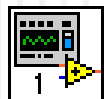


Realizarea Icon-ului

- Icon: este reprezentarea grafica a unui VI
- Prin Right-click pe icon-ul generic (default) din Panou sau Diagrama

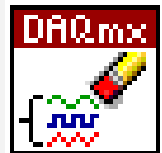
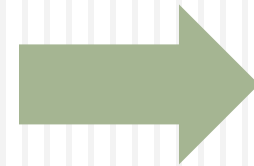
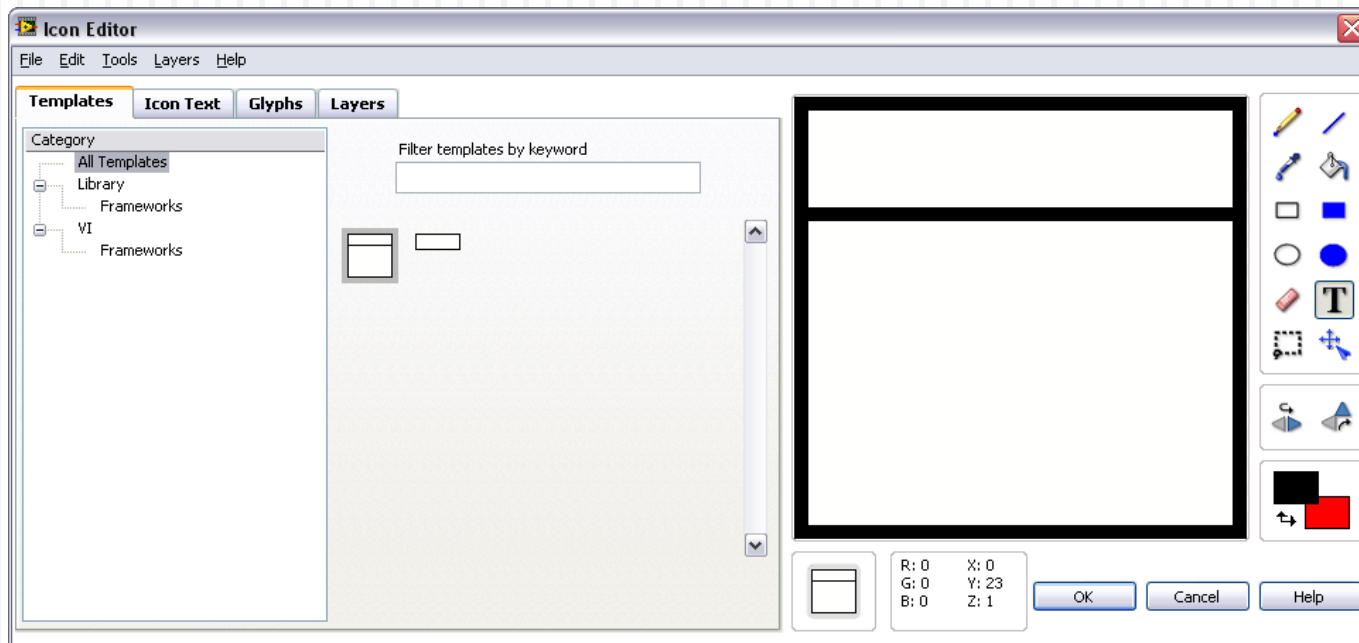
Un editor de Icon-uri

Default Icon



Realizarea Icon-ului

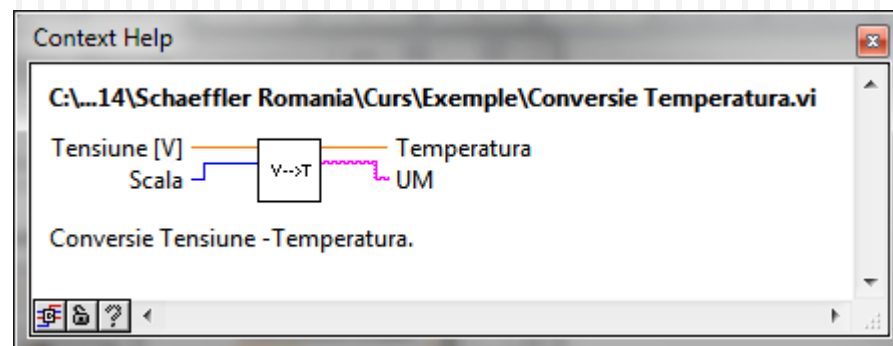
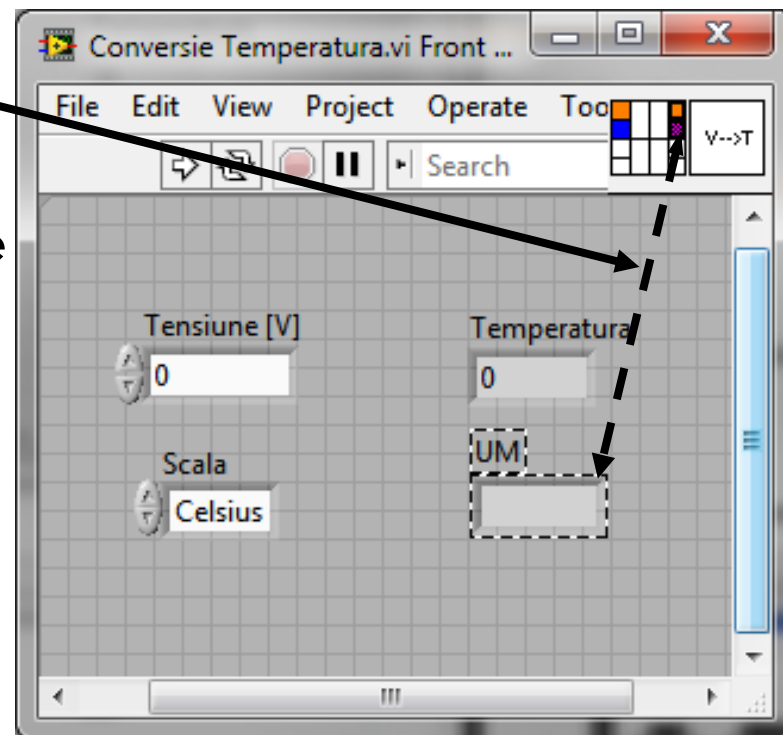
- Utilizarea sabloanelor - Templates tab
- Identificarea subVI-urilor pe proiect (grup de interes)



Realizarea Conectorului – cablarea lui

60

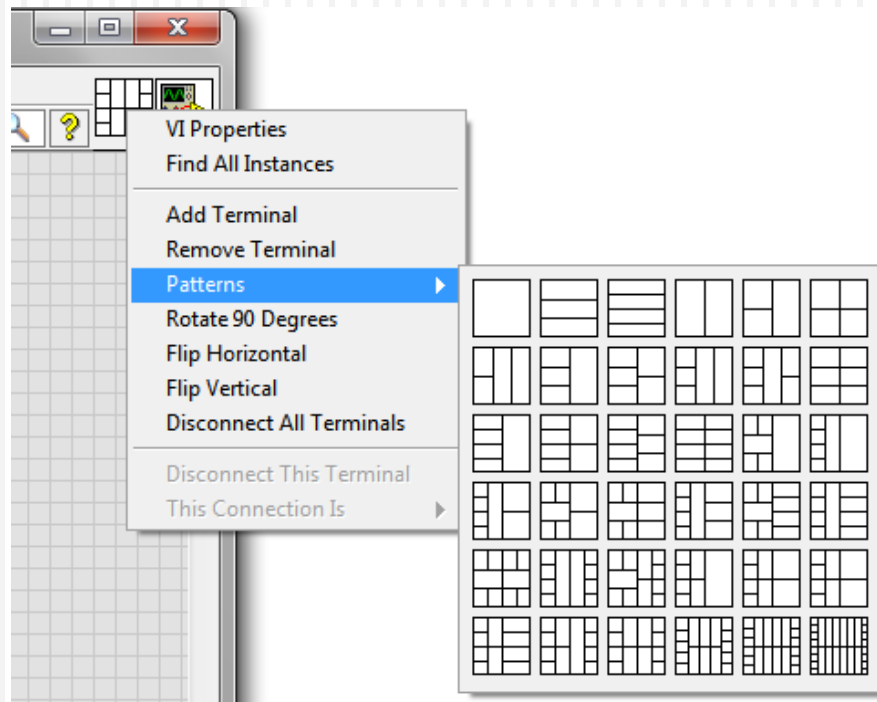
- Utilizand unealta de conectare
- Culoarele terminalelor din conector, sunt alese automat functie de tipul de date la care terminalul este conectat
- Prin Left-Click pe un terminal va arata automat obiectul asociat din PANOU



Realizarea Conectorului – Alegerea conectorului

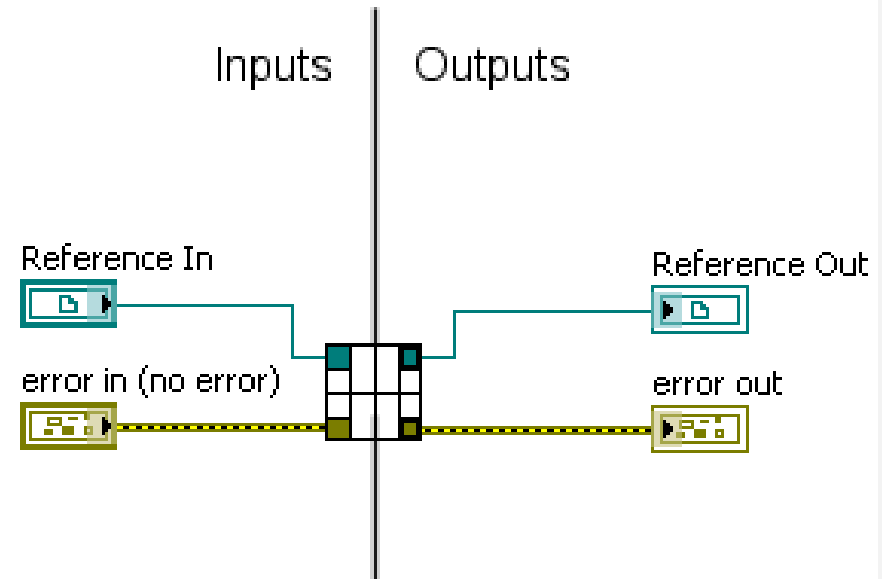
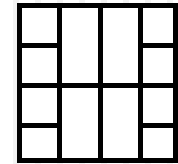
61

- Daca tipul conectorului predefinit nu este cel dorit acesta se poate schimba prin Right-Click pe conector urmat de alegerea unui tip de conector convenabil din fereastra corespunzatoare optiunii Patterns



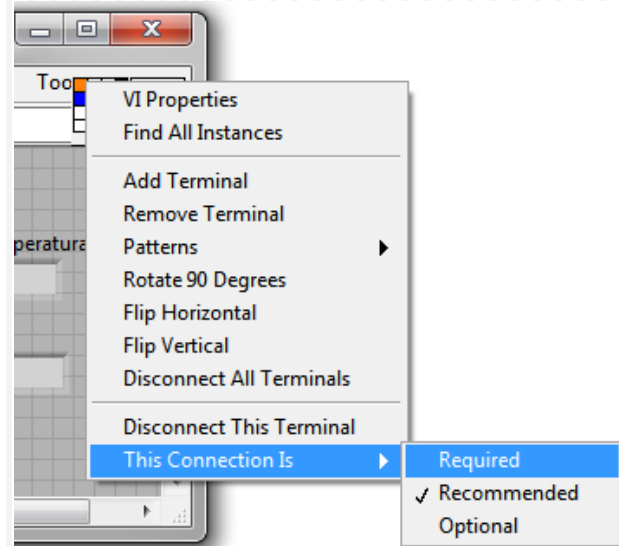
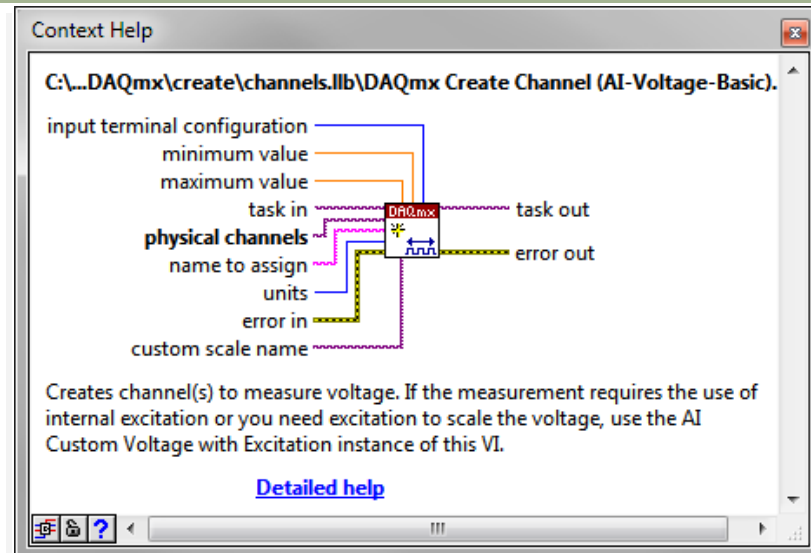
Conector – Standard

- Default se utilizeaza conectorul cu 12 terminale
- Recomanda pentru a fi folosit
 - ▣ Structura standard
 - ▣ Terminalele de sus (stanga si dreapta) sunt utilizate pentru conectarea referintelor (file reference, DAQmx task)
- Terminalele de jos (stanga si dreapta) sunt utilizate pentru conectarea cluster-ilor de eroare



Configurare terminale

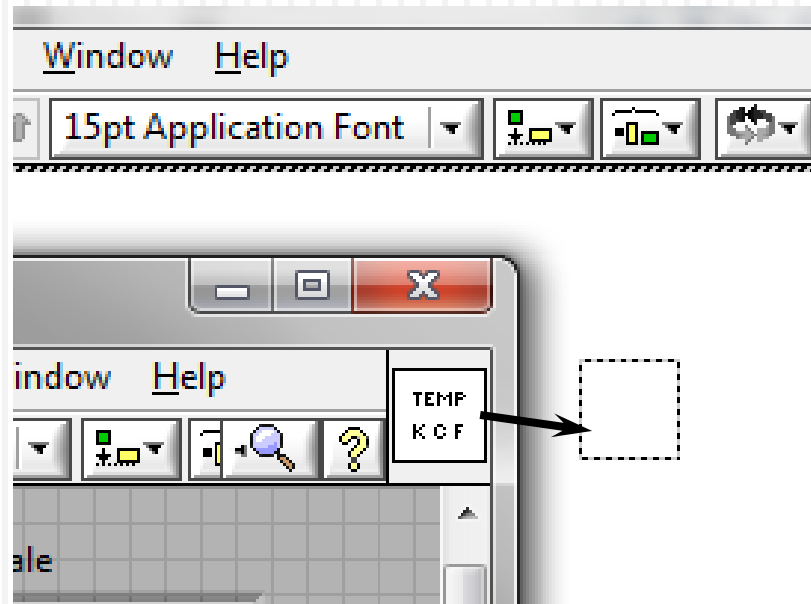
- **Bold** – obligatoriu de conectat
 - Plain – recomandat pentru a fi conectat
 - Dimmed – optional
-
- Alegerea optiunii pentru terminal:
 - Right-Click pe terminal si alegea optiunii dorite



Utilizarea unui VI ca un SubVI

64

- All Functions»Select a VI... >> cautare VI pe HDD >> selectare – Open sau Double Click
- sau
- Daca este deschis Panoul prin “Drag icon” in Diagrama dorita



subVI in VI

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