MERNI INFORMACIONI SISTEMI

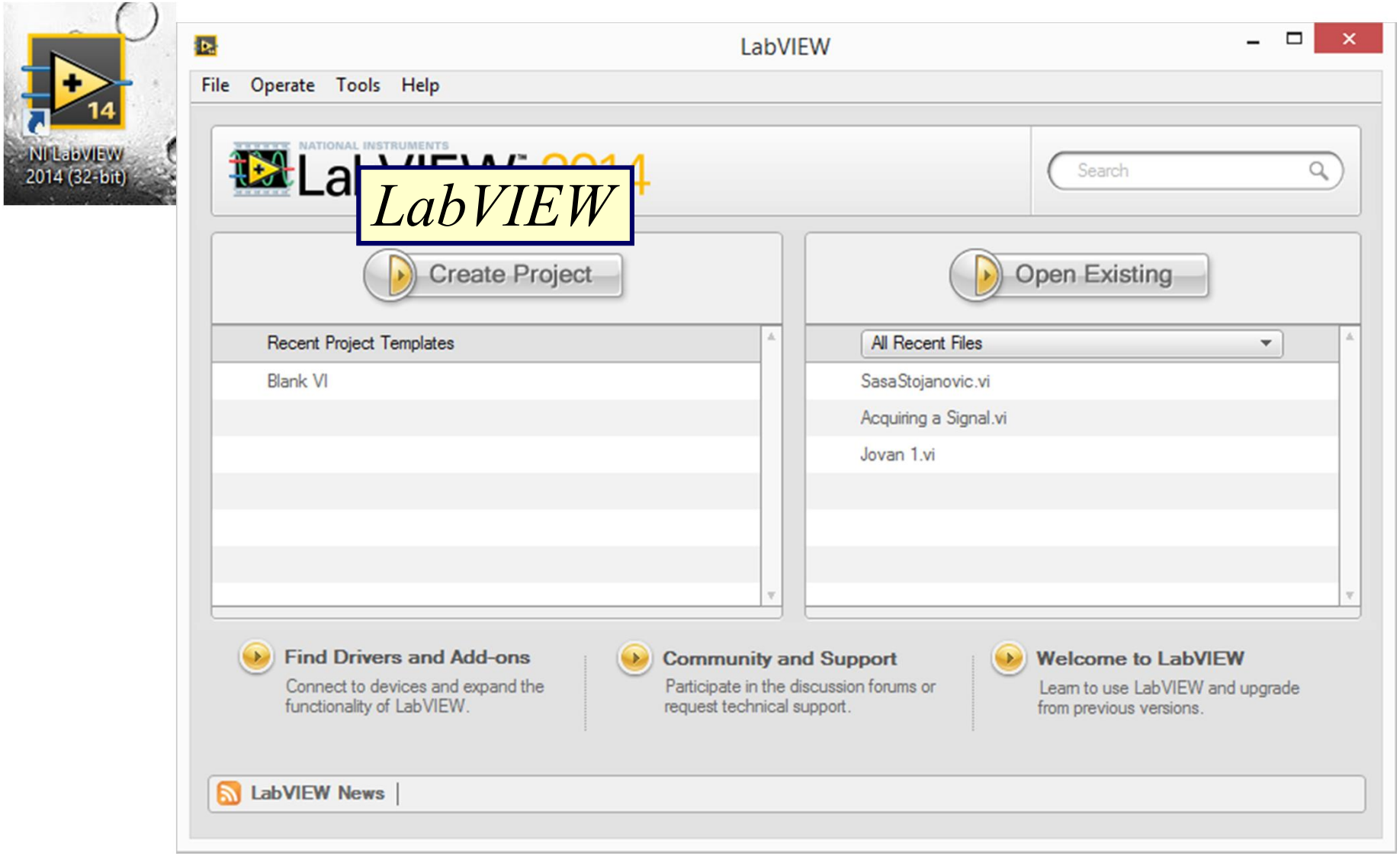
Profesor dr Miroslav Lutovac

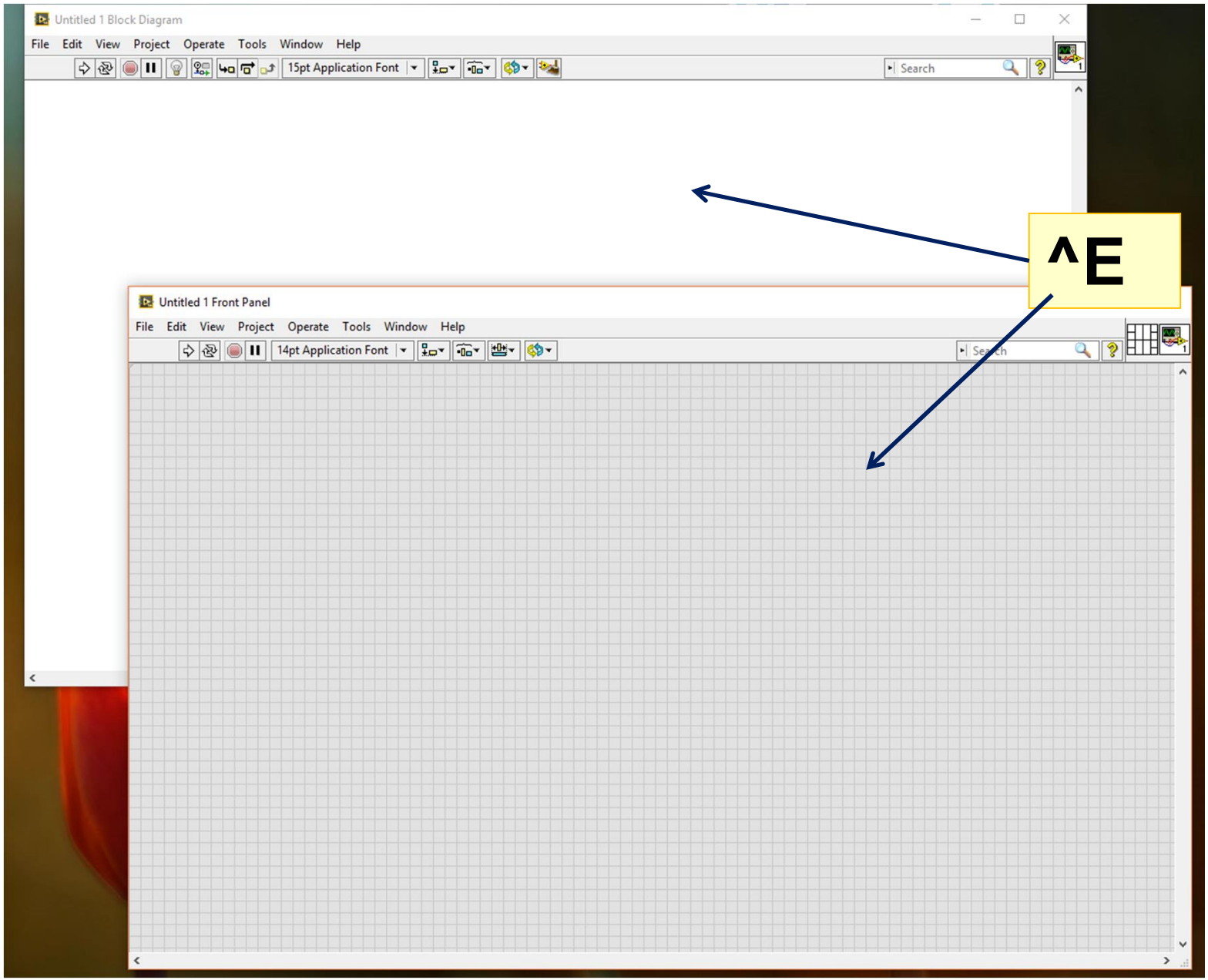
mlutovac@viser.edu.rs

Primer spektralne analize

LabVIEW
vremensko-frekvencijska analiza

- Napravi LabVIEW virtuelni instrument
  - Generiši sinusoidalni signal
  - Iskoristi funkcije za analizu da izračunate spektar snage signala sa brzom furijeovom analizom (Fast Fourier Transform - FFT)
  - Grafički prikazati spektar u funkciji učestanosti

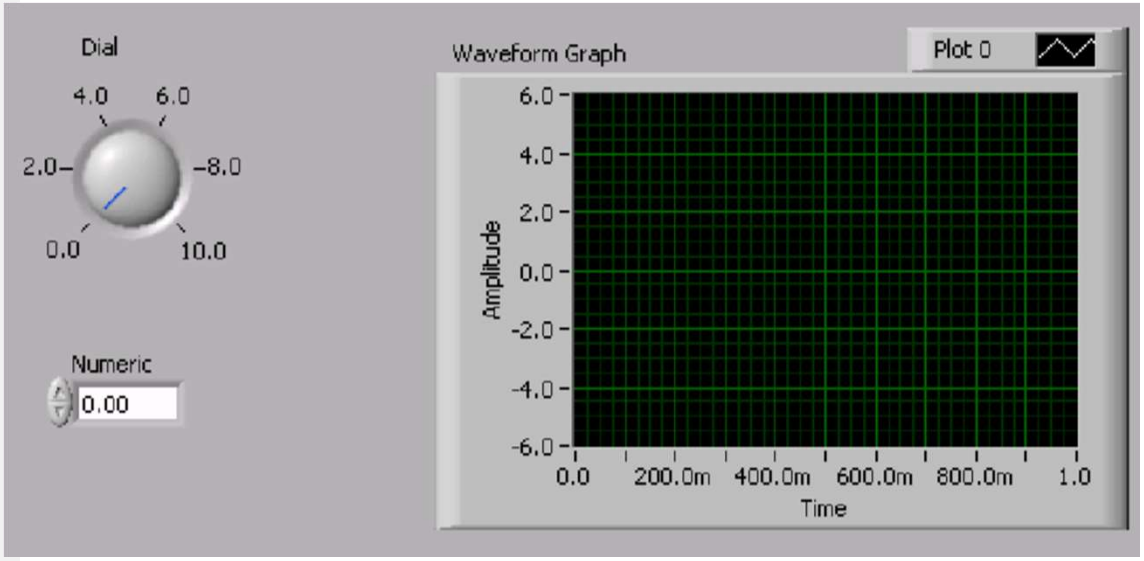

NI LabVIEW
2014 (32-bit)
LabVIEW
File Operate Tools Help
NATIONAL INSTRUMENTS
LabVIEW 2014
Search
LabVIEW
Create Project
Open Existing
Recent Project Templates
Blank VI
All Recent Files
SasaStojanovic.vi
Acquiring a Signal.vi
Jovan 1.vi
Find Drivers and Add-ons
Connect to devices and expand the functionality of LabVIEW.
Community and Support
Participate in the discussion forums or request technical support.
Welcome to LabVIEW
Learn to use LabVIEW and upgrade from previous versions.
LabVIEW News


Untitled 1 Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
^E
Untitled 1 Front Panel
File Edit View Project Operate Tools Window Help
14pt Application Font

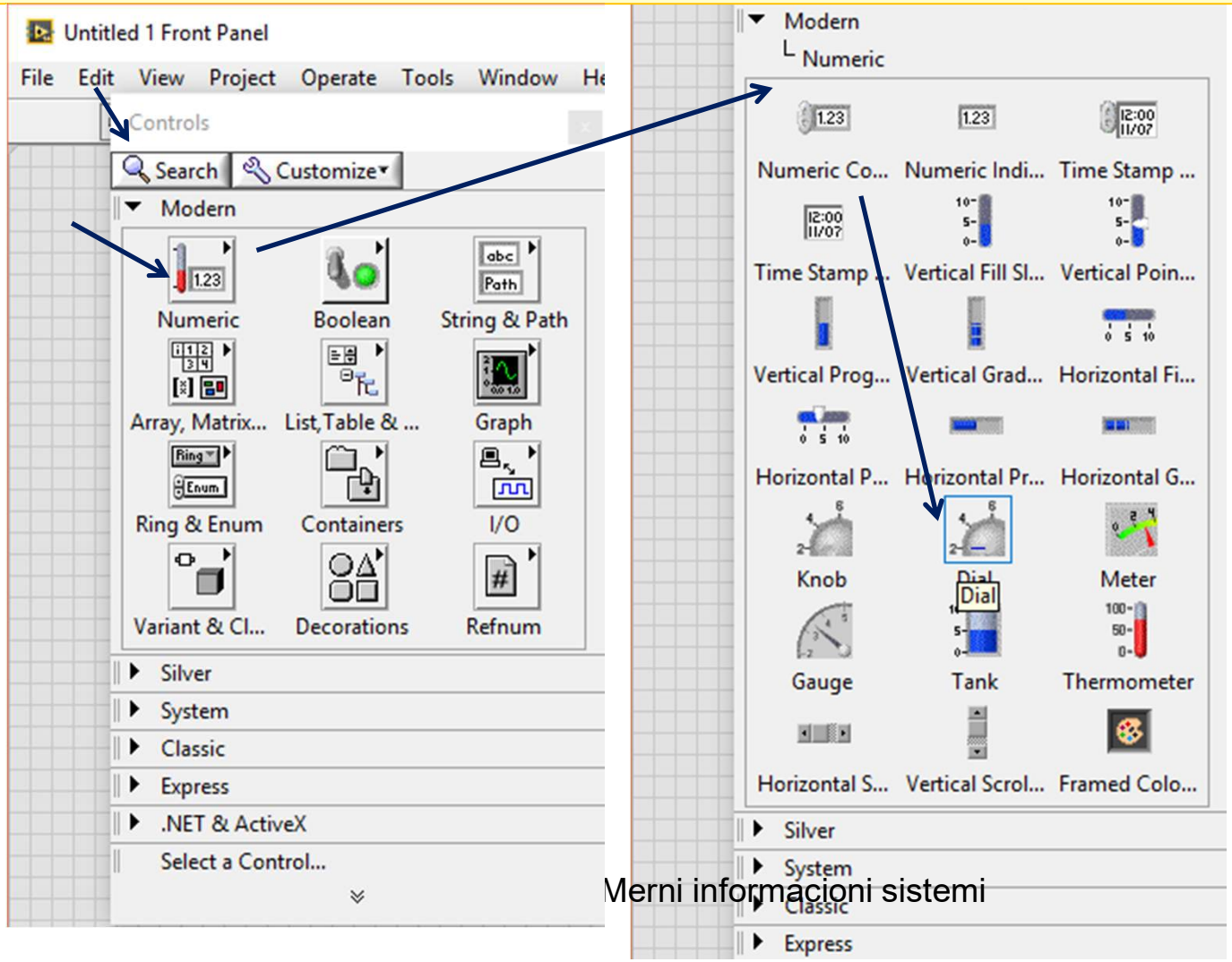
Učenje kroz primere

- choose **New VI**
- two windows
- gray window titled “Untitled 1” is the front panel - user interface
- white window titled “Untitled 1 Diagram” is the block diagram
- Click on the **front panel** window and create the user interface

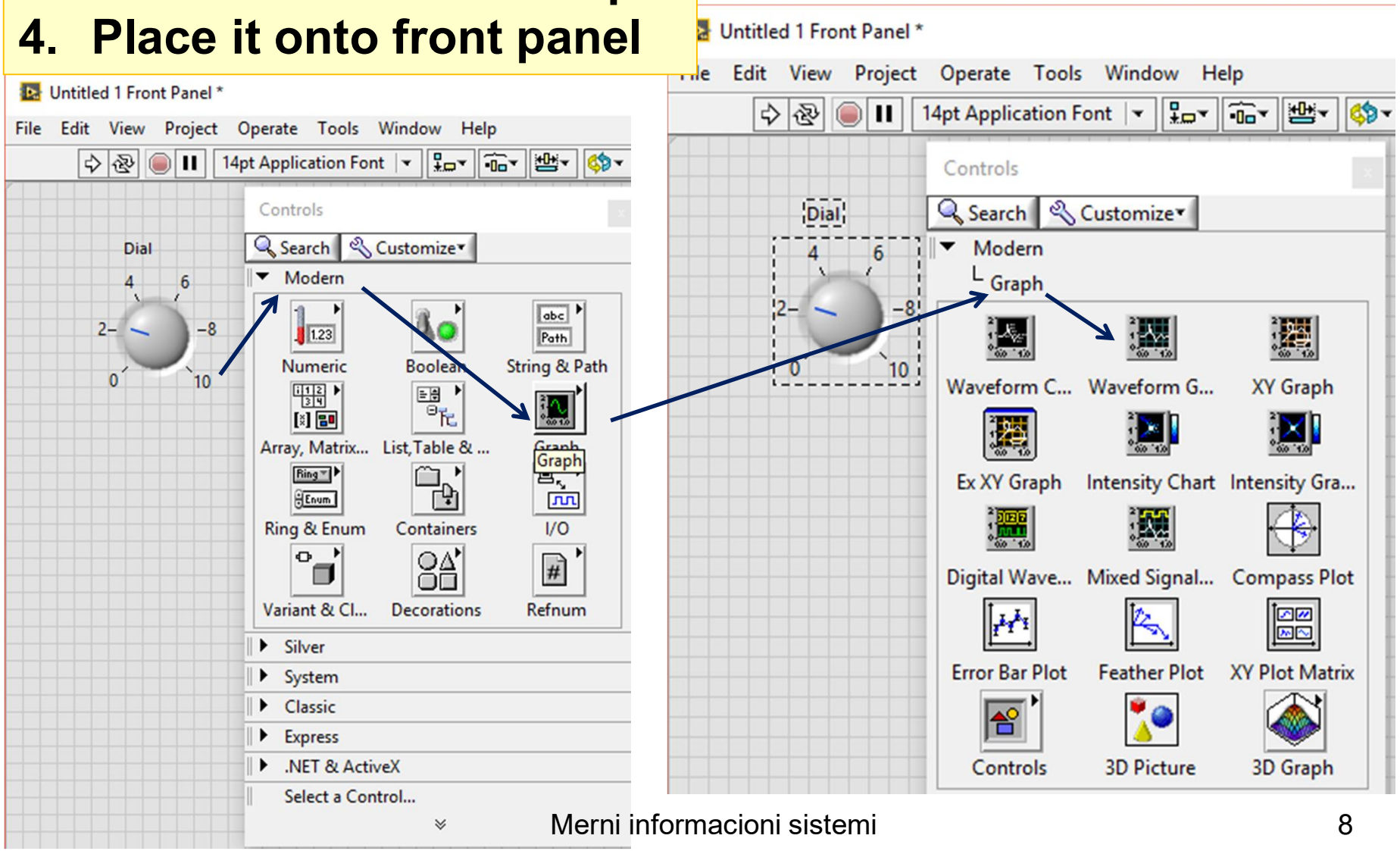
1. Click on the **Controls palette** window
2. The Controls palette contains objects
3. **Mouse over the subpalettes** and **see descriptions** in the **top of the window**

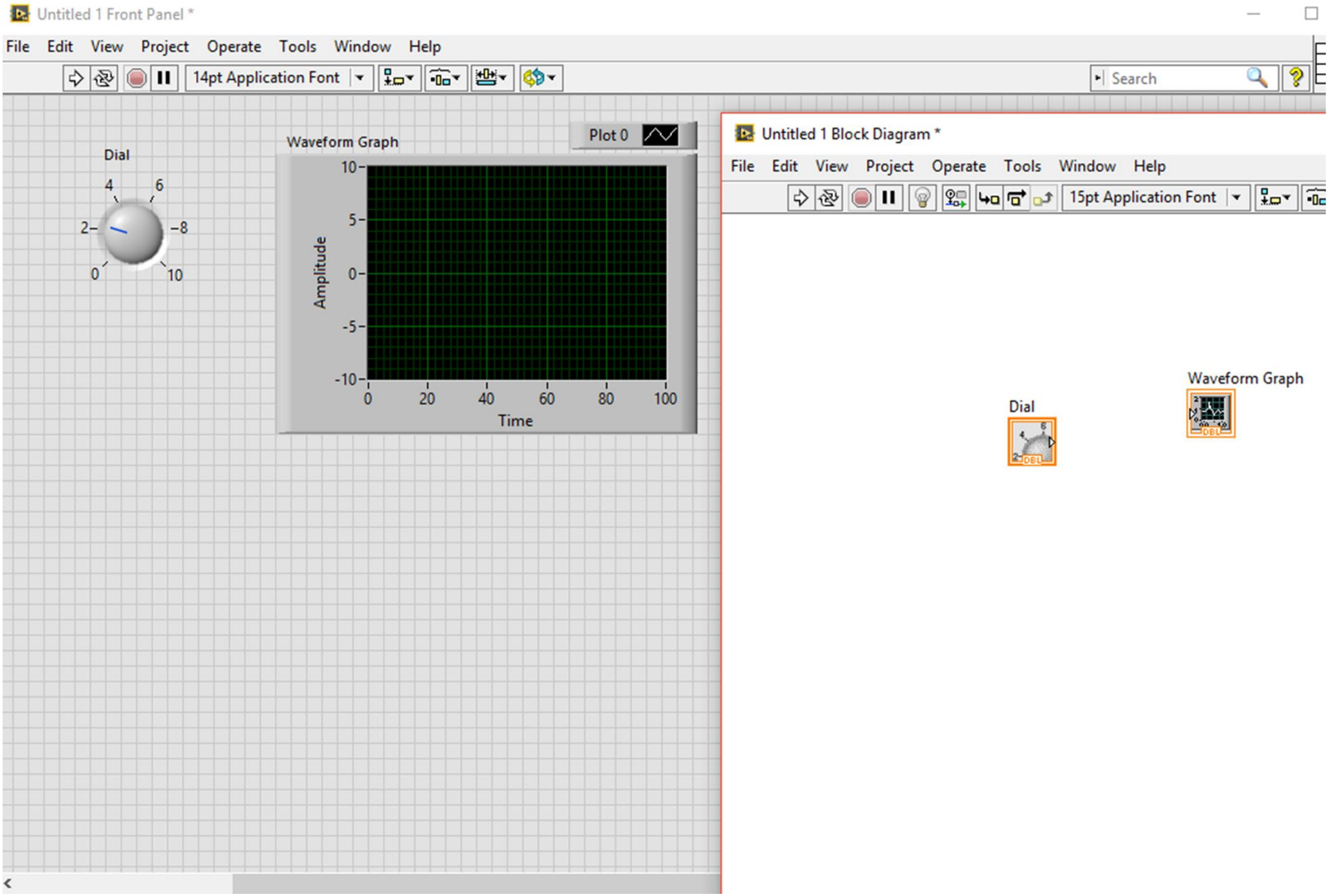


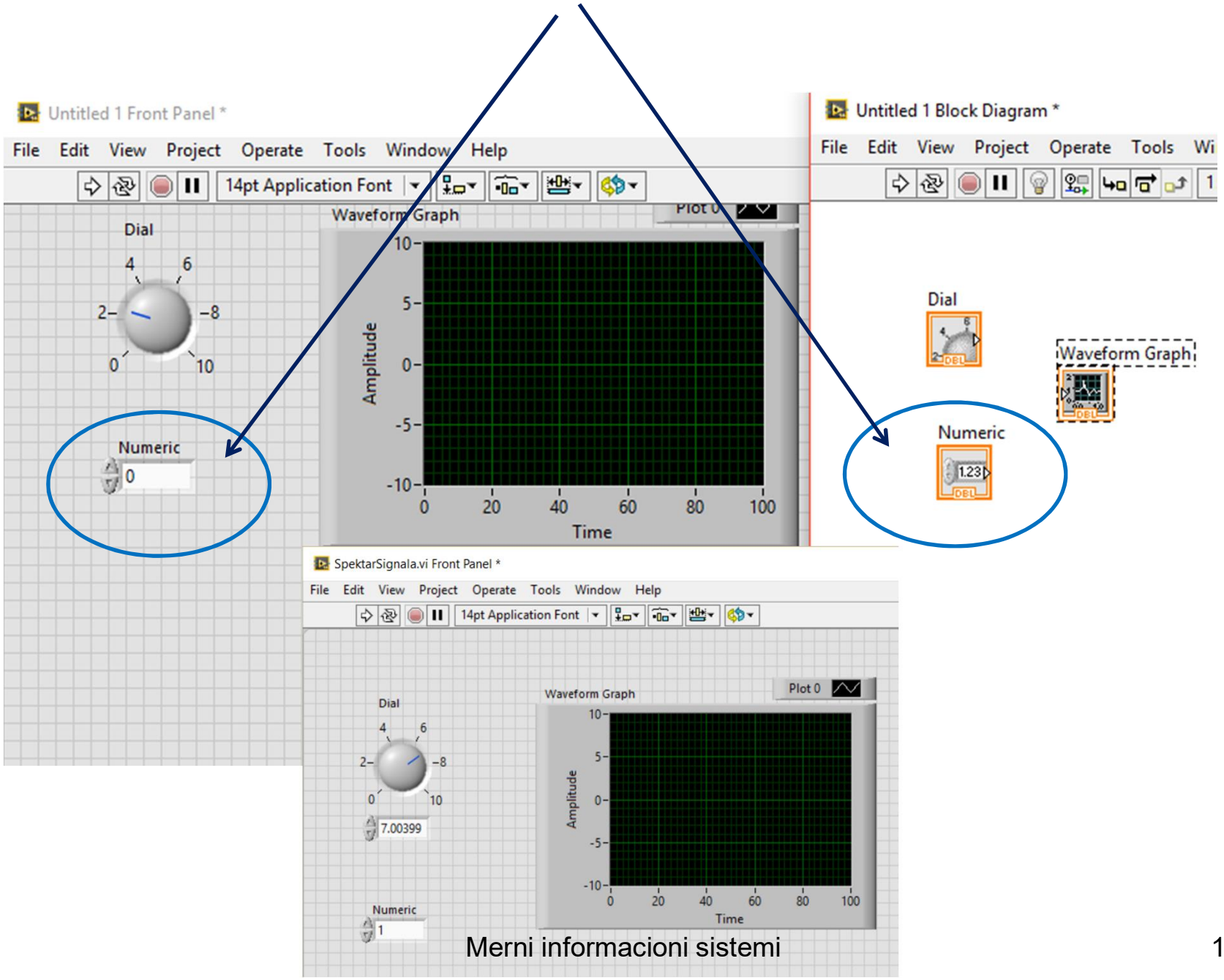
1. From the Controls palette, select the **Numeric sub-palette**
2. Click on the **Dial control**
3. **Move the mouse** to the **front panel**
4. Click the **left mouse button to drop** the Dial onto the panel



1. From **Modern sub-palette**
2. Select **Graph sub-palette**
3. Click on **Waveform Graph**
4. **Place it onto front panel**

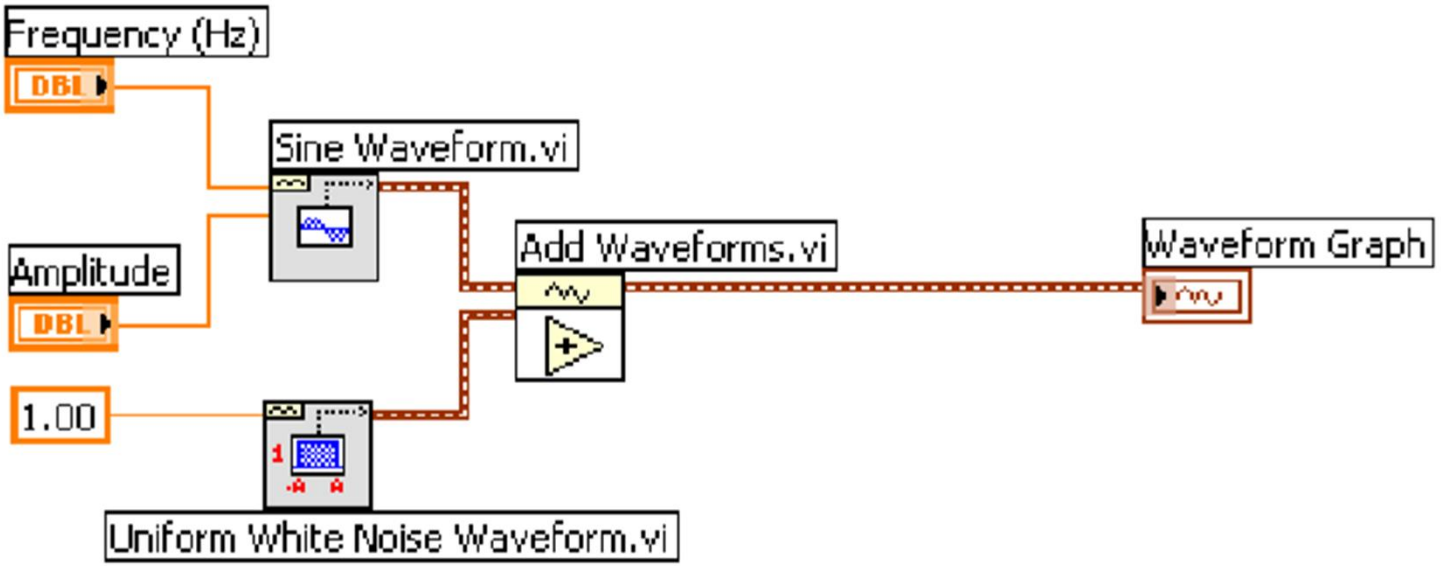



Untitled 1 Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
Search
Dial
Waveform Graph
Plot 0
Amplitude
Time
Untitled 1 Block Diagram *
File Edit View Project Operate Tools Window Help
15pt Application Font
Dial
Waveform Graph

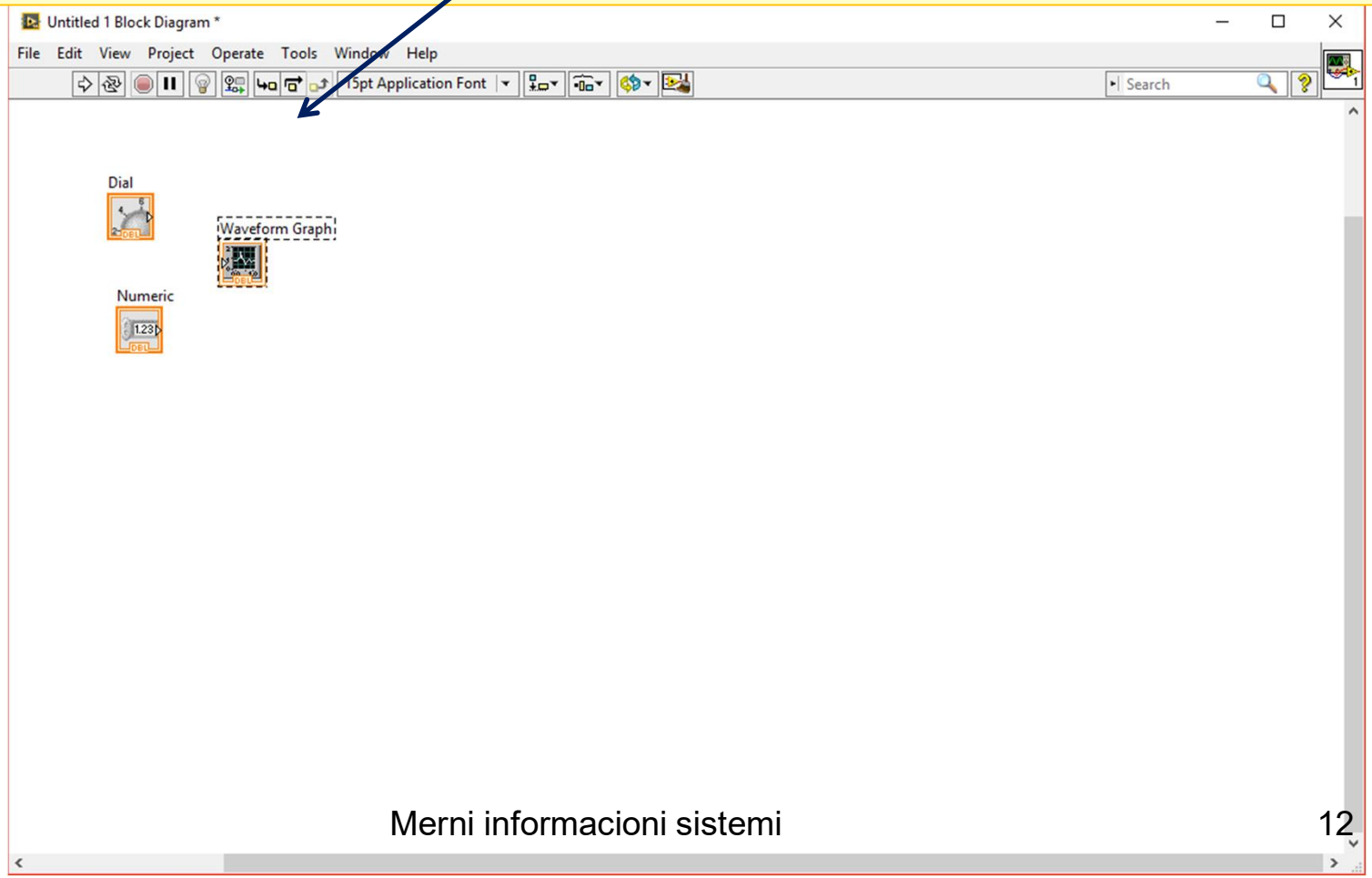

Untitled 1 Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
Dial
Waveform Graph
Amplitude
Time
Numeric
Untitled 1 Block Diagram *
File Edit View Project Operate Tools Wi
Dial
Waveform Graph
Numeric
SpektarSignala.vi Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
Dial
Waveform Graph
Plot 0
Amplitude
Time
7.00399
Numeric

Cilj: pravljenje složenije šeme

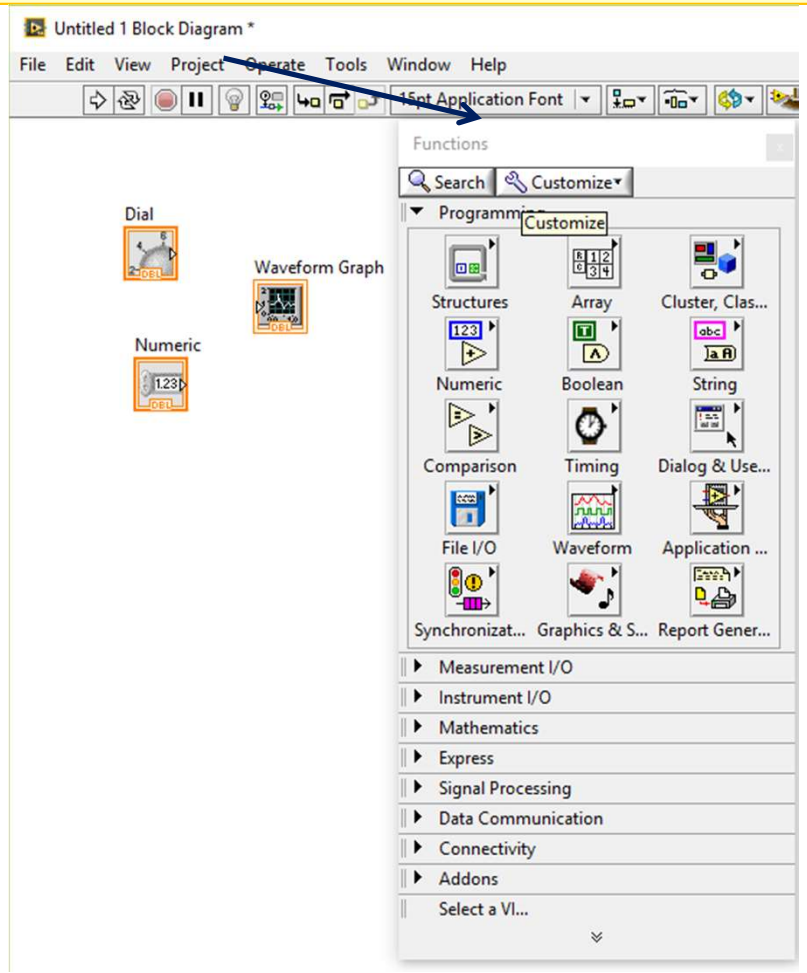
1. The next steps are to create the block diagram code



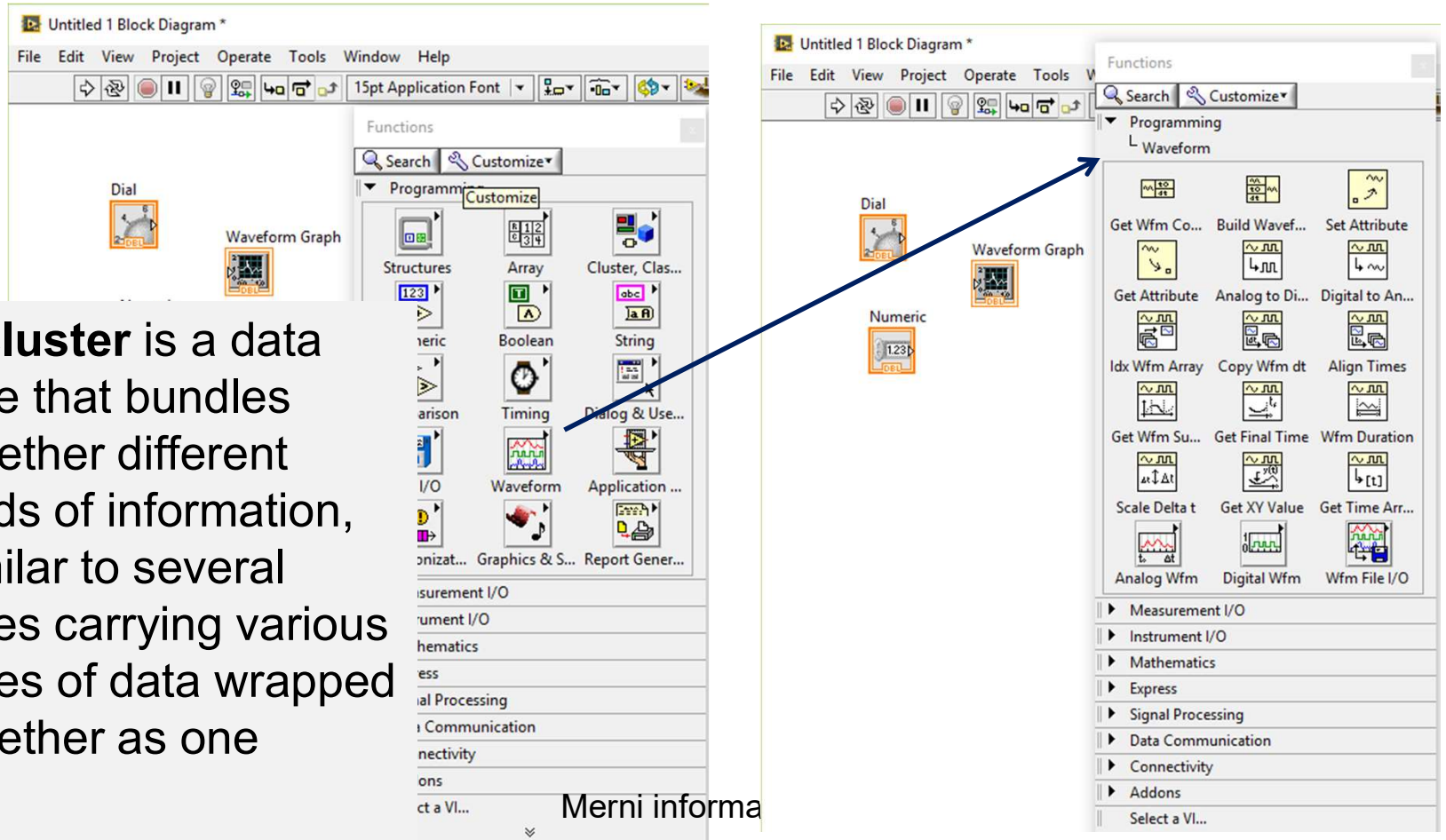
Click on the block diagram window (behind the front panel,
^E
Three nodes on the block diagram
These nodes correspond to the objects
placed on the front panel



1. Controls palette has been replaced by the **Functions palette**
2. It contains all of the LabVIEW functions that can be combined to create custom application
3. Reposition the Functions palette so that you can view the entire window on your screen

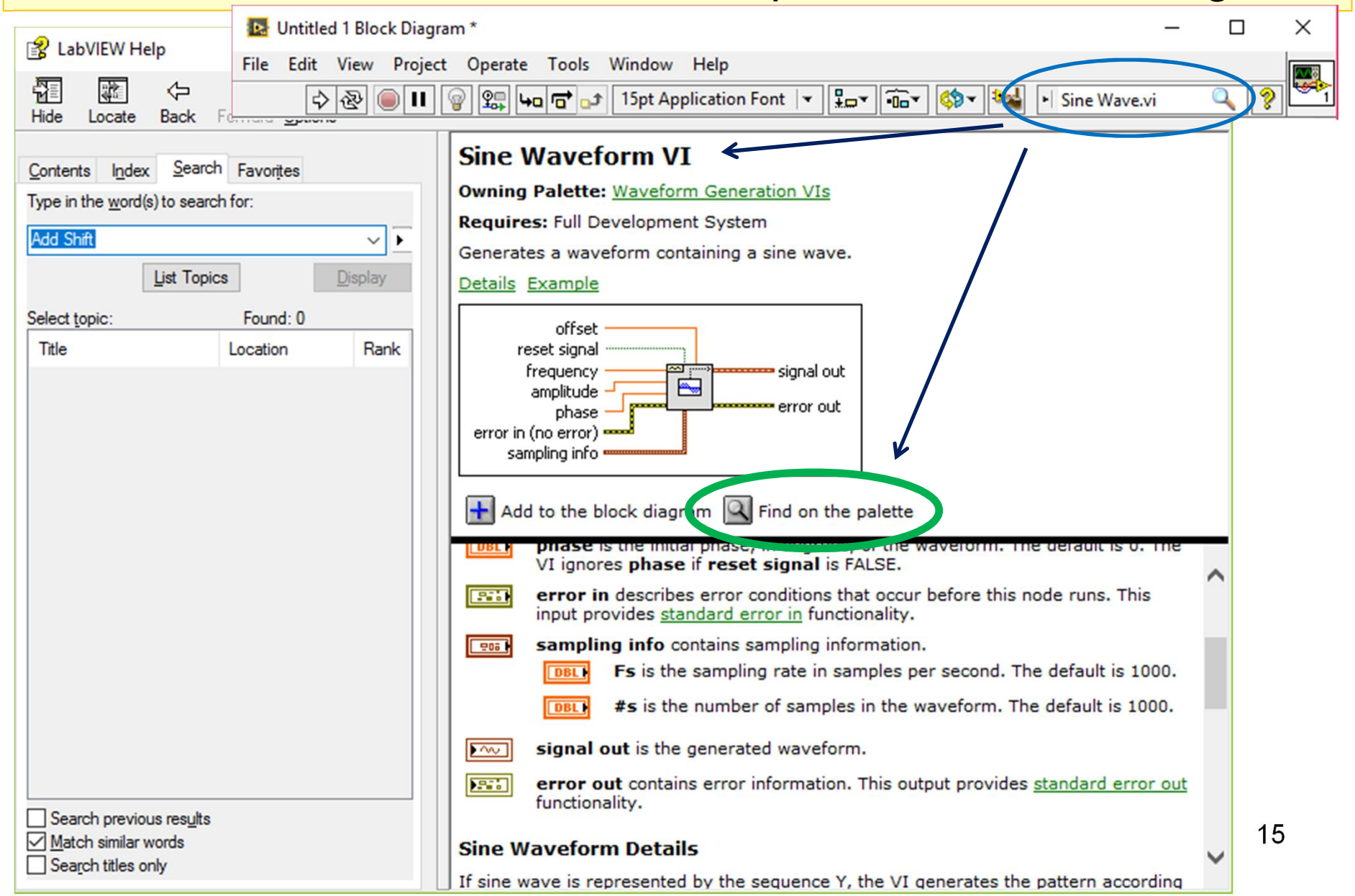


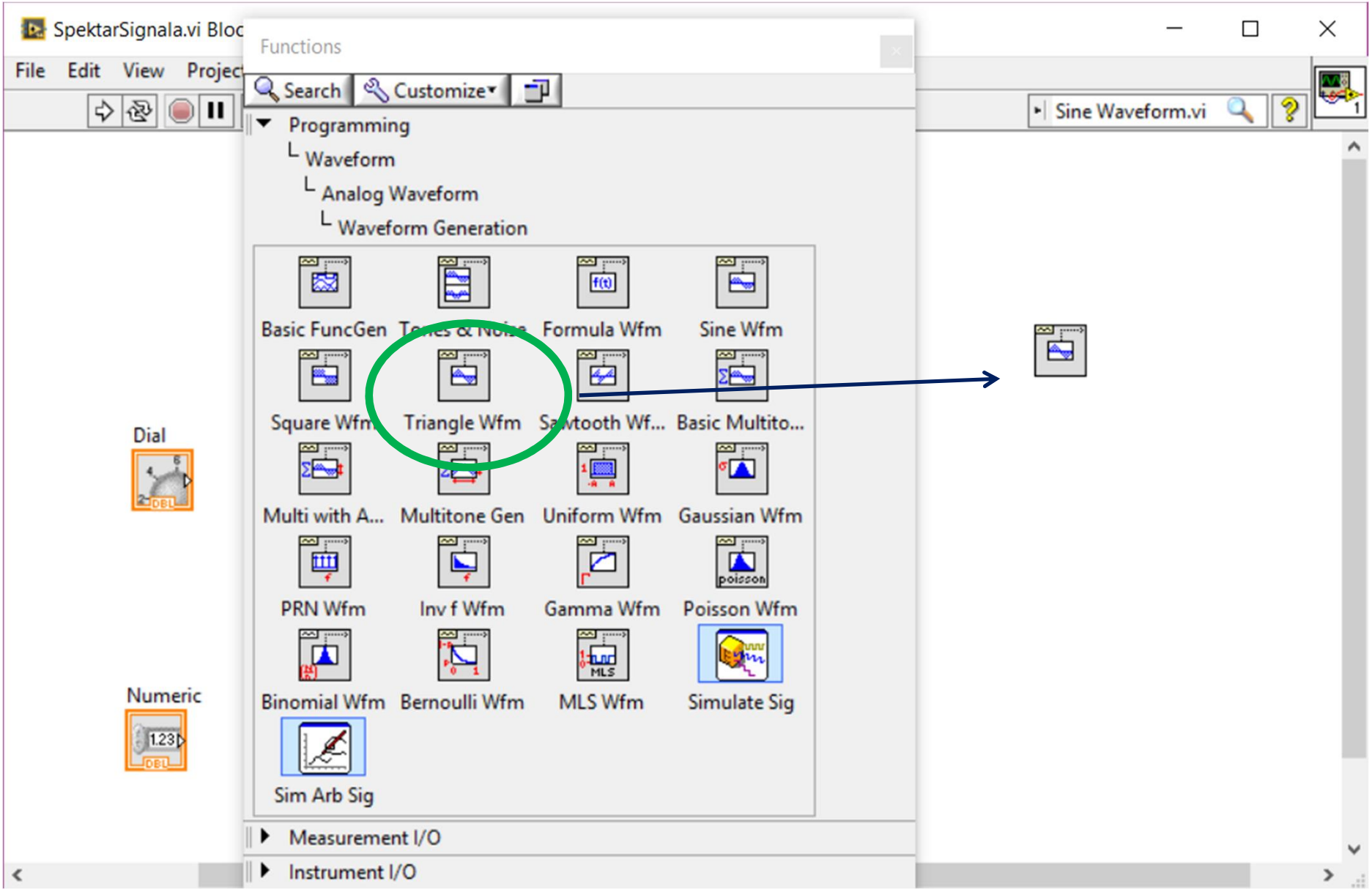
1. Within the Functions palette, select **Waveform sub-palette**
2. It contains functions performed on the waveform data type
3. The **waveform data type** is a unique feature of LabVIEW
4. It is a special kind of cluster that succinctly contains both **amplitude and timing information of a signal**



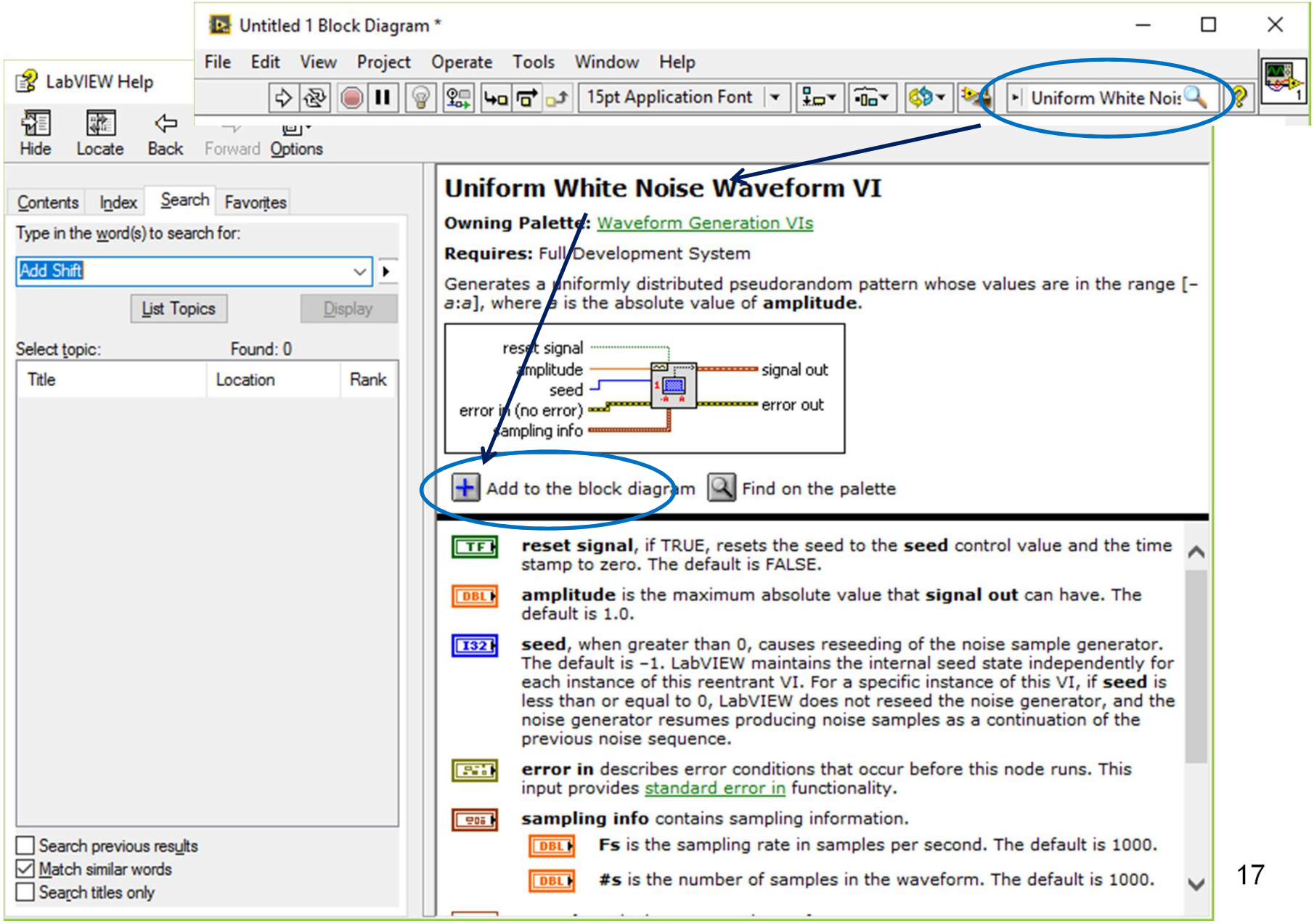
A **cluster** is a data type that bundles together different kinds of information, similar to several wires carrying various types of data wrapped together as one

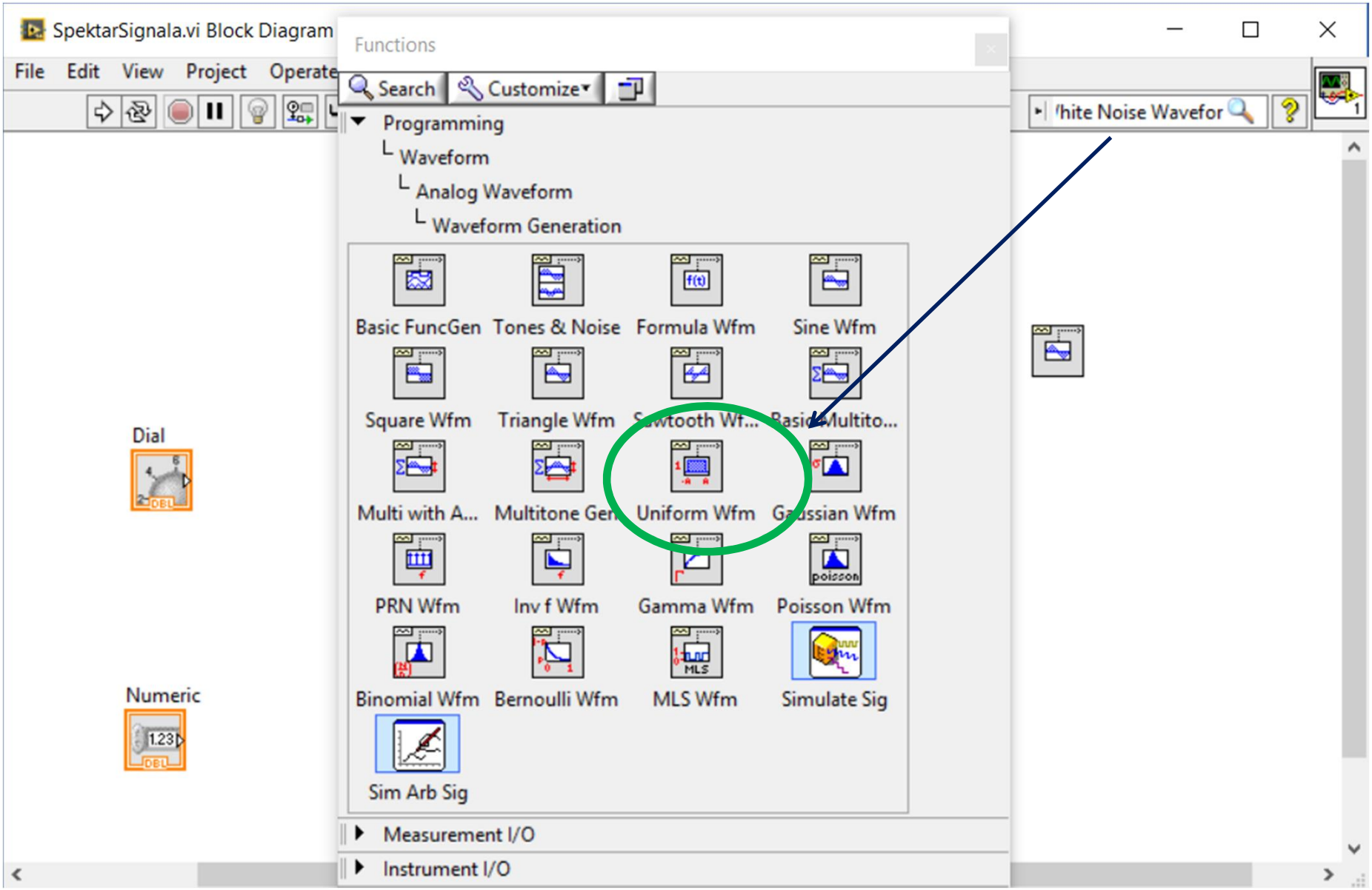
1. Waveform Generation menu
2. Choose the Sine Wave.vi and drop it onto the block diagram

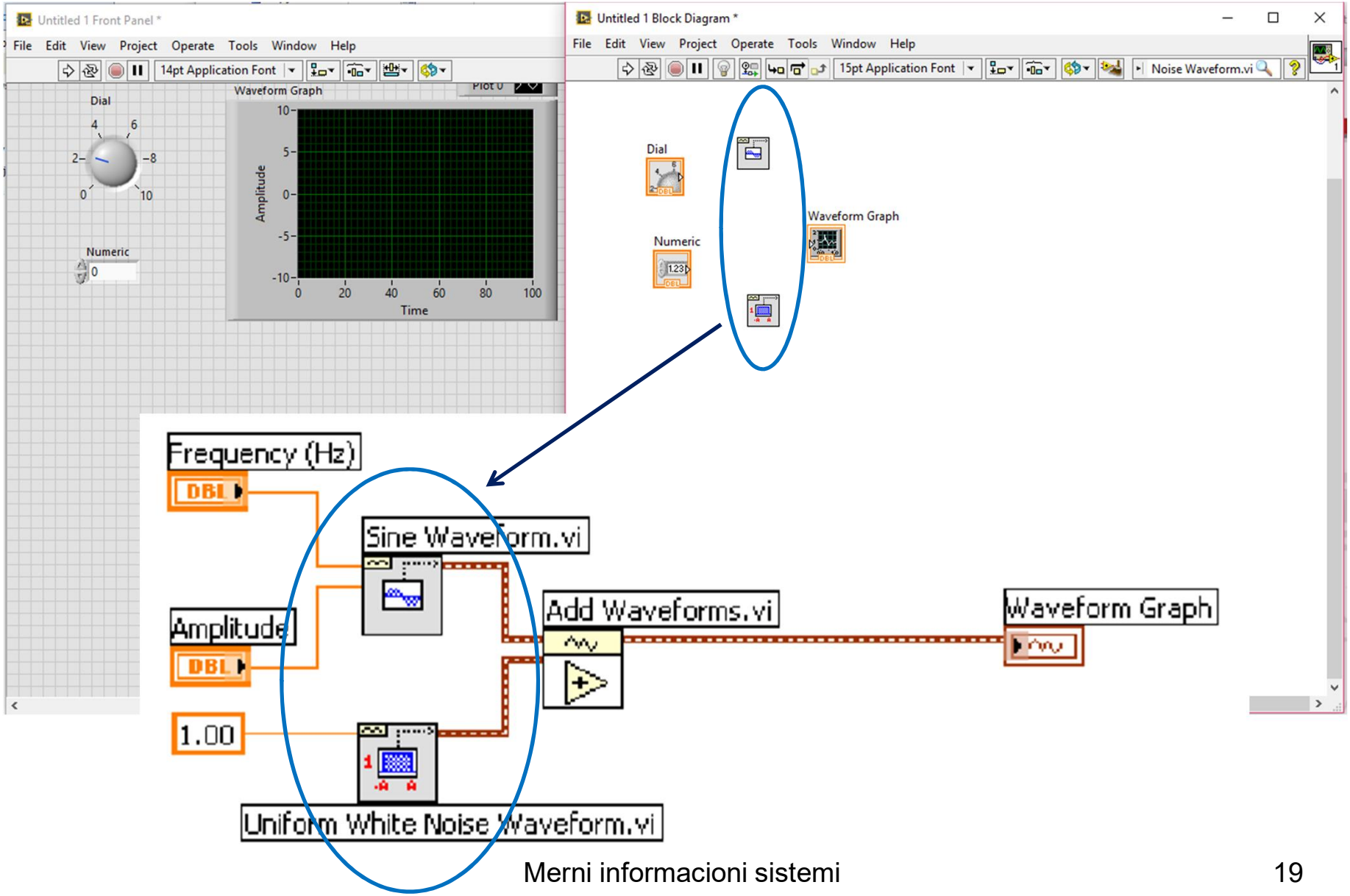


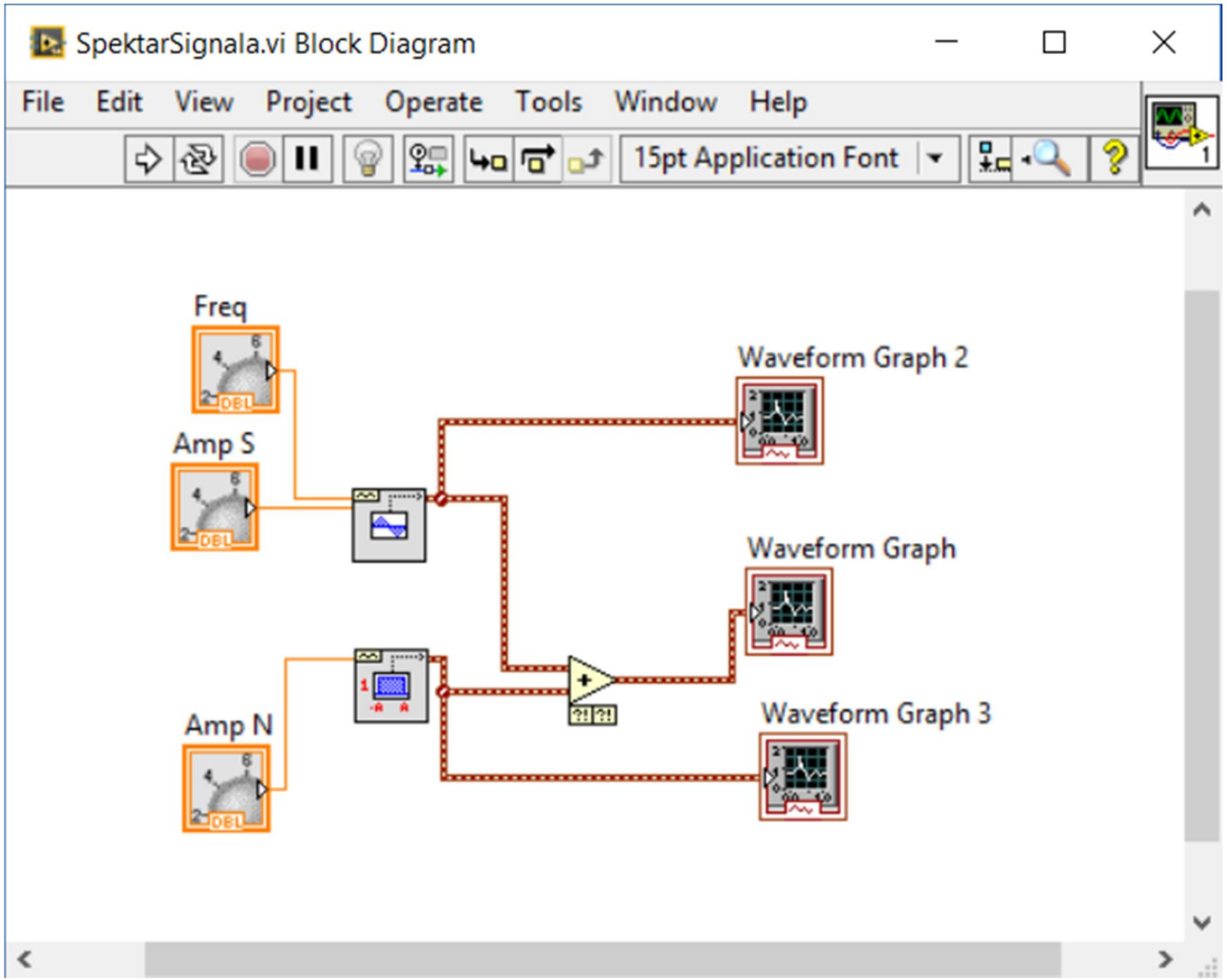

SpektarSignala.vi Bloc
File Edit View Projec
Functions
Search
Customize
Programming
Waveform
Analog Waveform
Waveform Generation
Basic FuncGen
Formula Wfm
Sine Wfm
Square Wfm
Triangle Wfm
Basic Multito...
Multi with A...
Multitone Gen
Uniform Wfm
Gaussian Wfm
PRN Wfm
Inv f Wfm
Gamma Wfm
Poisson Wfm
Binomial Wfm
Bernoulli Wfm
MLS Wfm
Simulate Sig
Sim Arb Sig
Measurement I/O
Instrument I/O
Sine Waveform.vi
Dial
Numeric

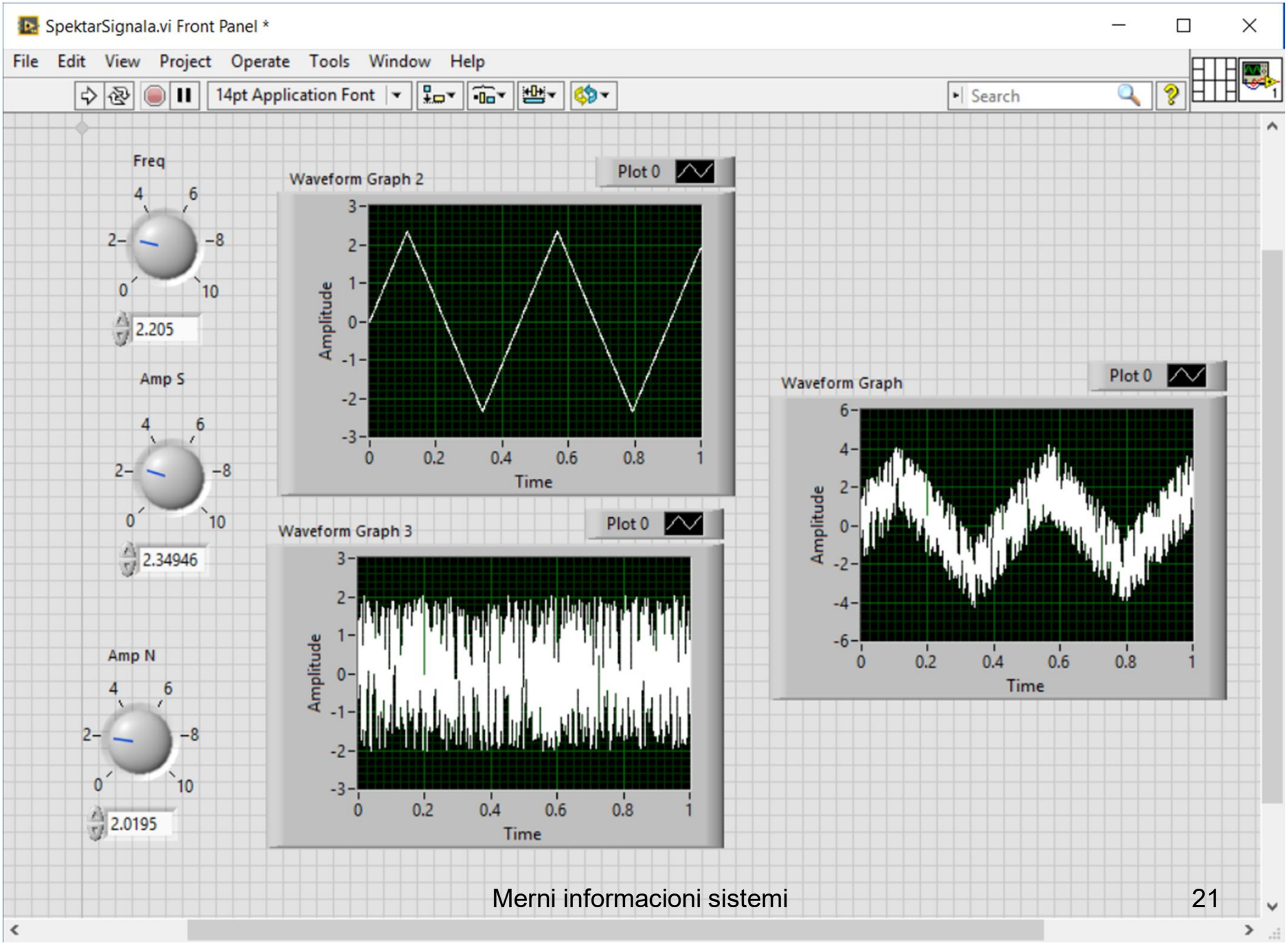
1. Choose the Uniform White Noise Waveform.vi

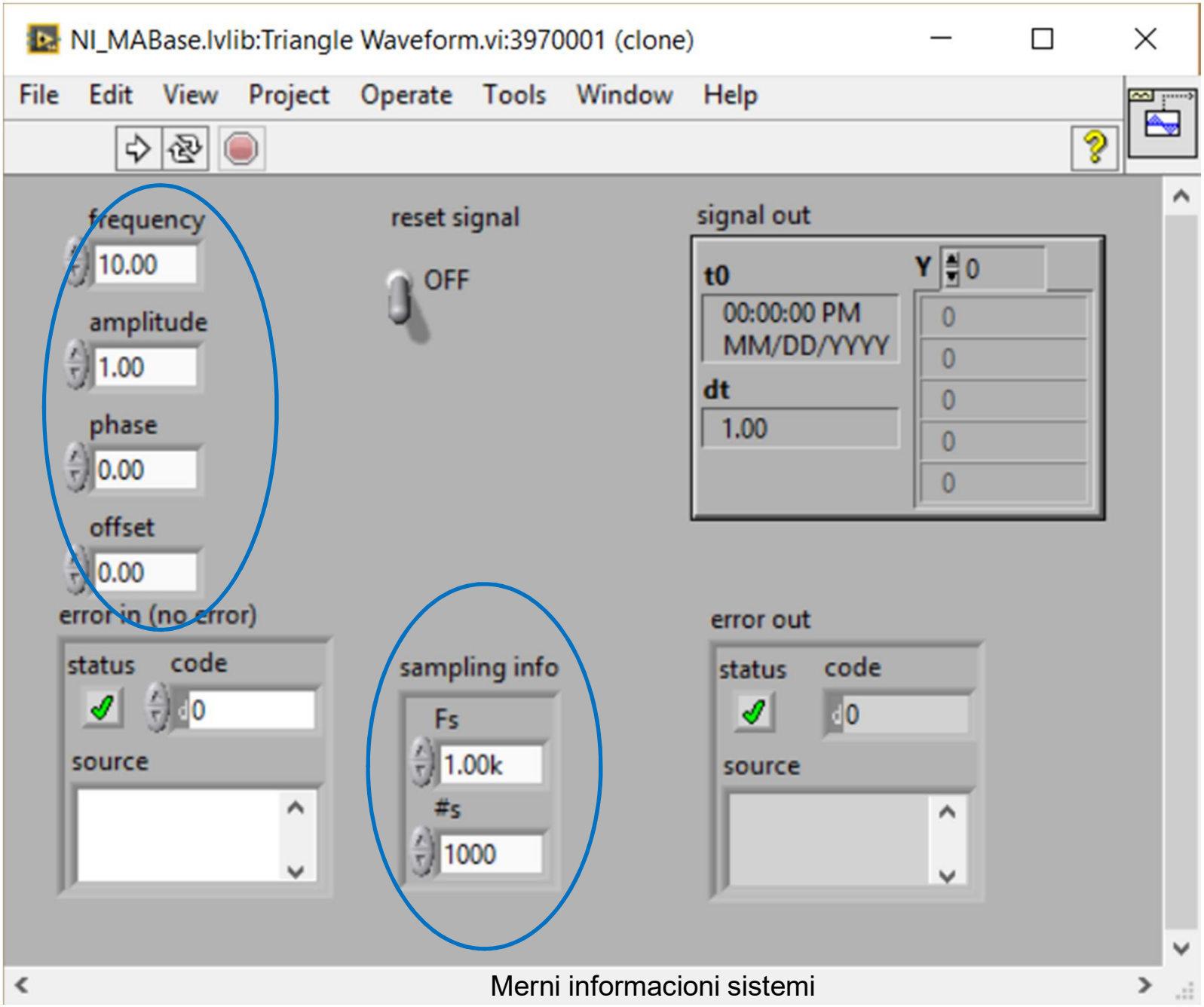


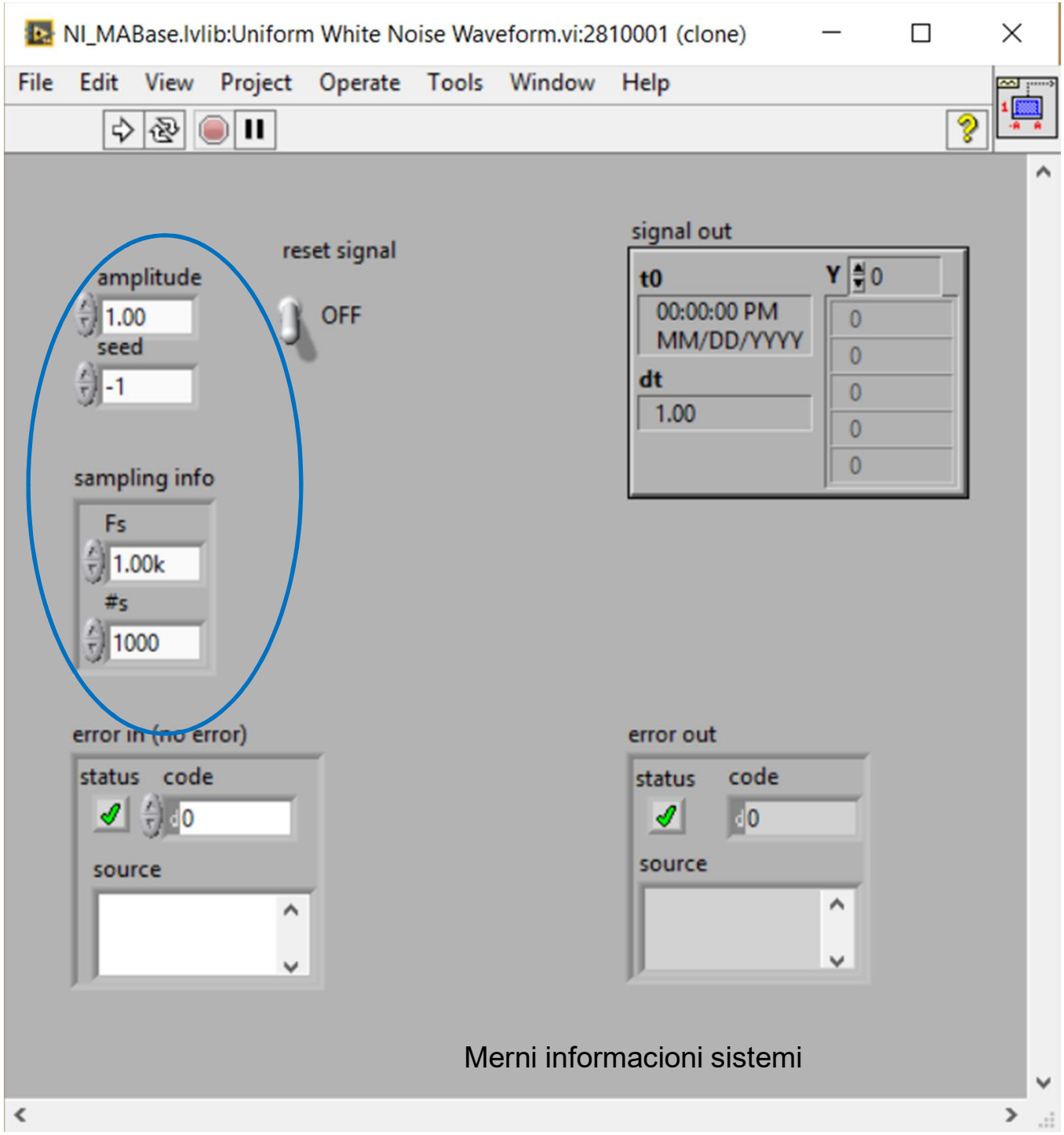

SpektarSignala.vi Block Diagram
File Edit View Project Operate
Functions
Search
Customize
Programming
Waveform
Analog Waveform
Waveform Generation
Basic FuncGen
Tones & Noise
Formula Wfm
Sine Wfm
Square Wfm
Triangle Wfm
Multi with A...
Multitone Gen
Uniform Wfm
PRN Wfm
Inv f Wfm
Gamma Wfm
Poisson Wfm
Binomial Wfm
Bernoulli Wfm
MLS Wfm
Simulate Sig
Sim Arb Sig
Measurement I/O
Instrument I/O
Dial
Numeric

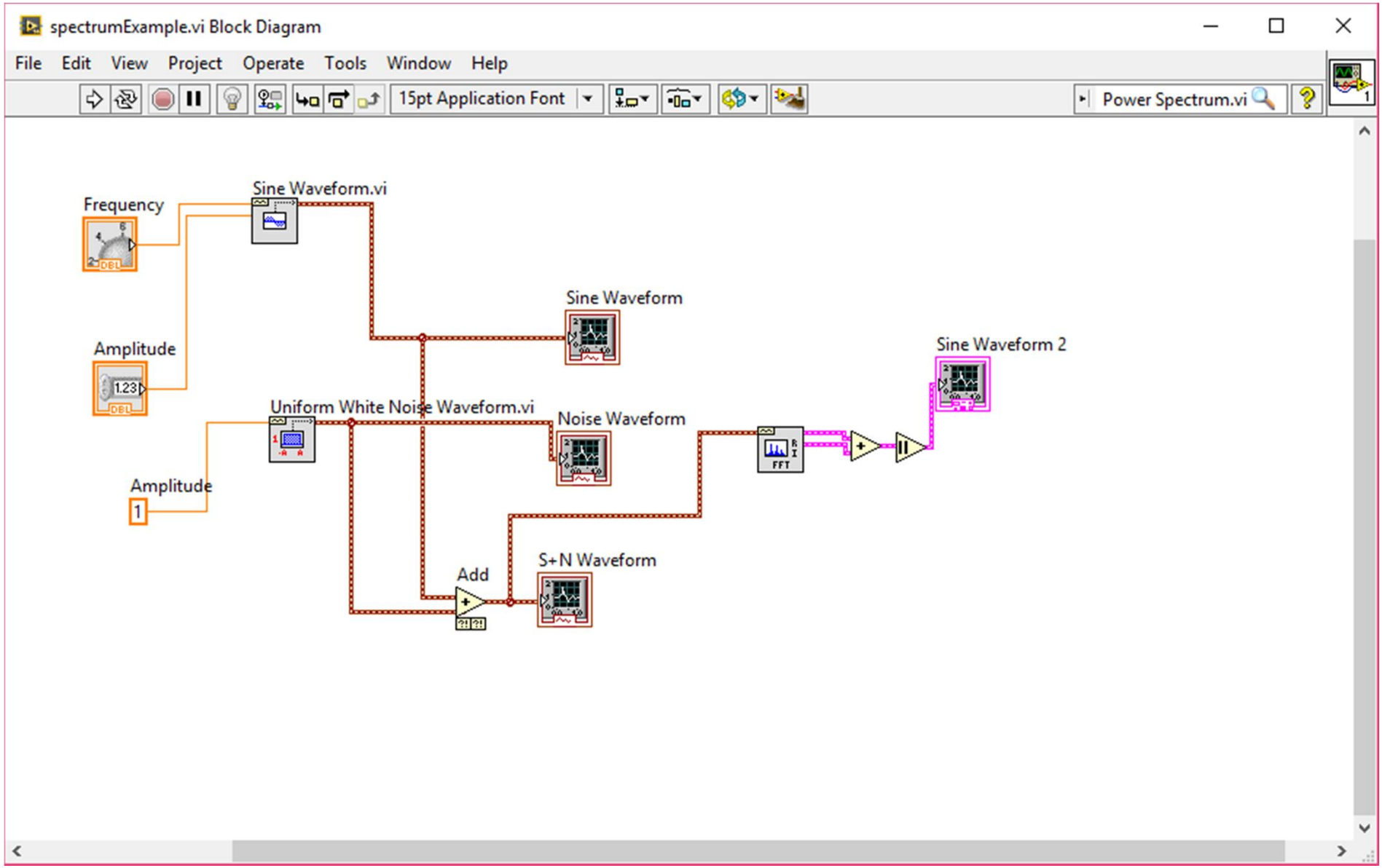

Untitled 1 Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
Dial
Waveform Graph
Amplitude
Time
Numeric
Untitled 1 Block Diagram *
15pt Application Font
Noise Waveform.vi
Dial
Numeric
Waveform Graph
Frequency (Hz)
DBL
Sine Waveform.vi
Amplitude
DBL
Add Waveforms.vi
Waveform Graph
1.00
Uniform White Noise Waveform.vi

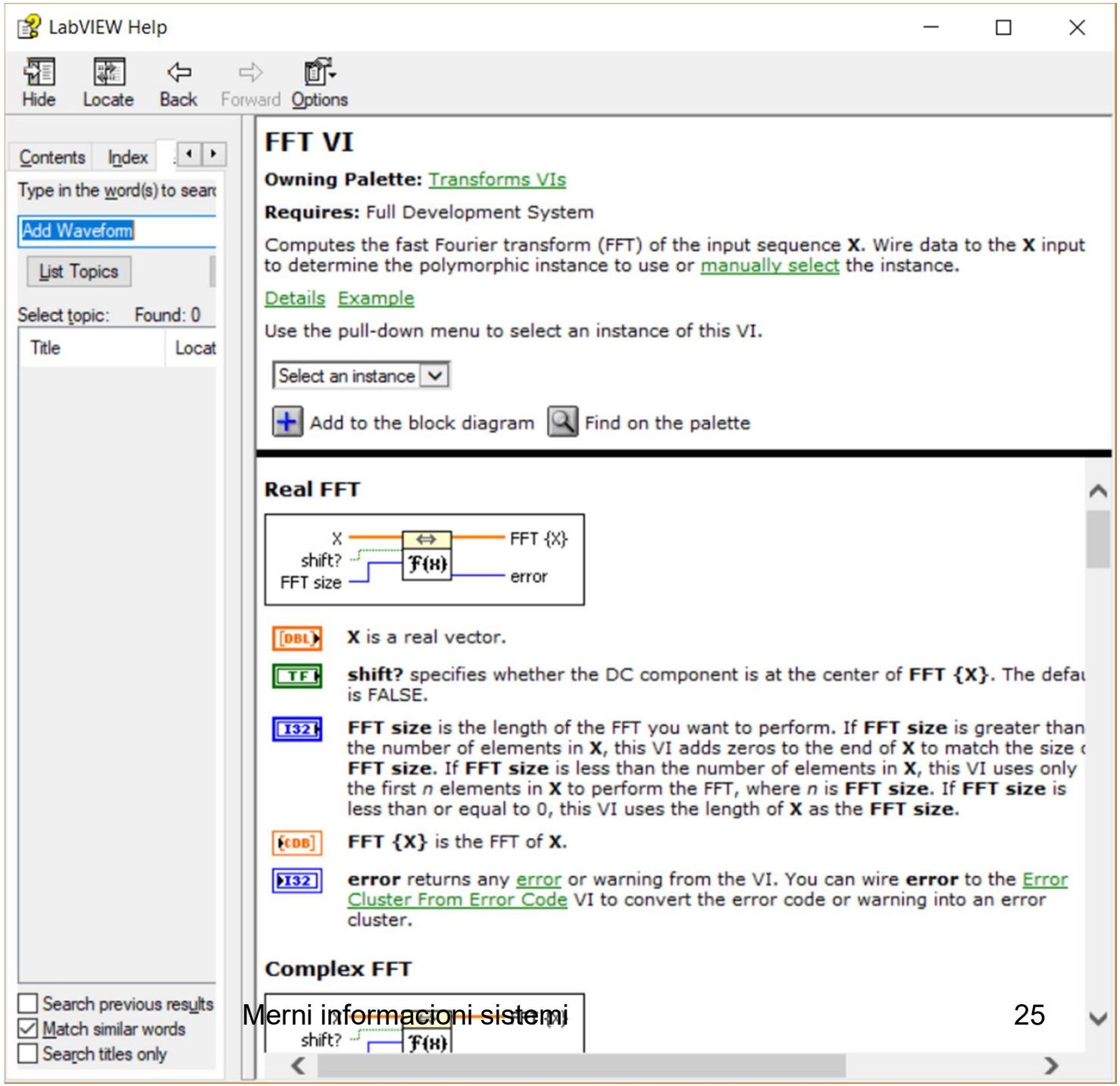

SpektarSignala.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Freq
Amp S
Amp N
Waveform Graph 2
Waveform Graph
Waveform Graph 3

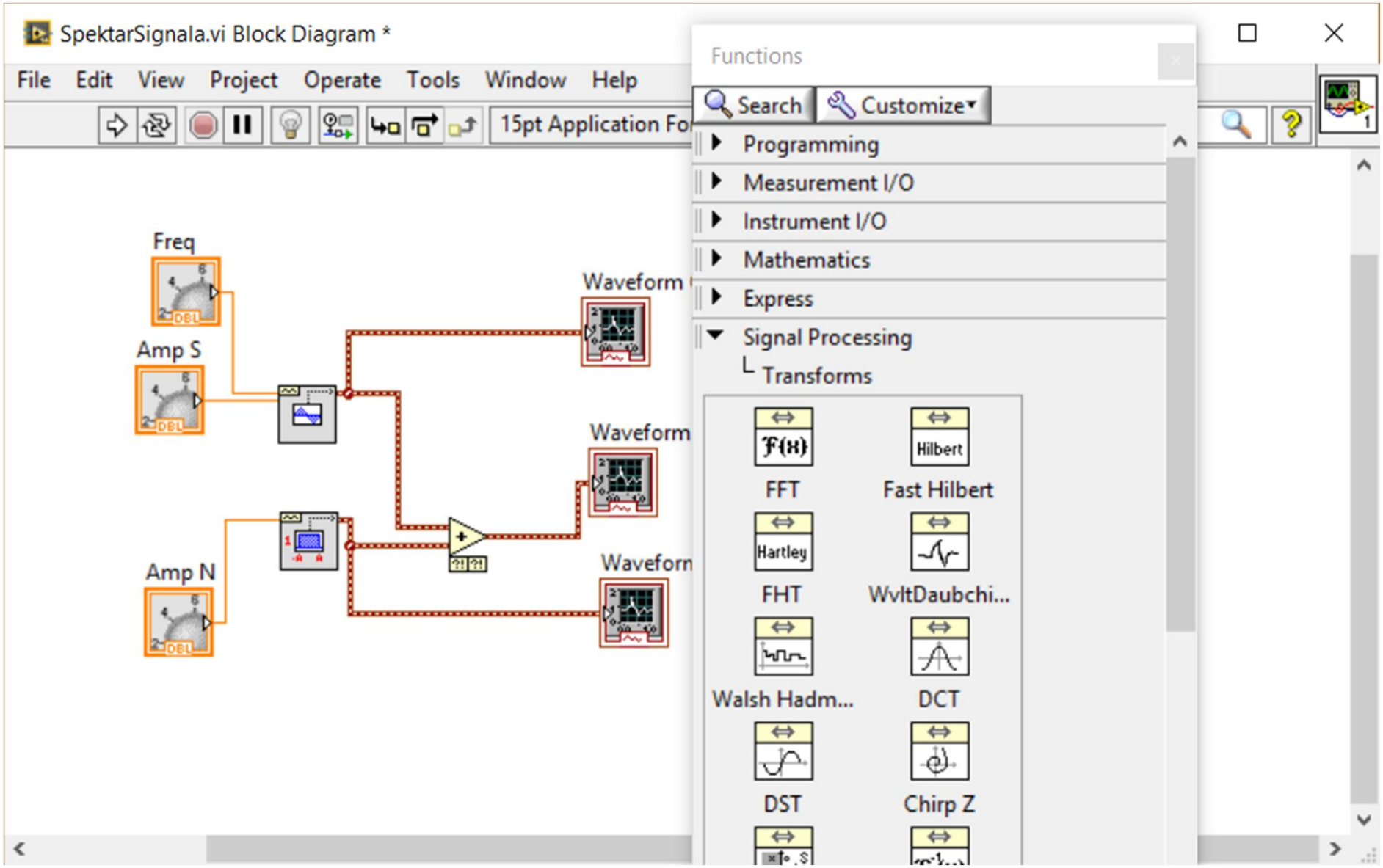

SpektarSignala.vi Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
Search
Freq
2.205
Amp S
2.34946
Amp N
2.0195
Waveform Graph 2
Plot 0
Amplitude
Time
Waveform Graph 3
Plot 0
Amplitude
Time
Waveform Graph
Plot 0
Amplitude
Time

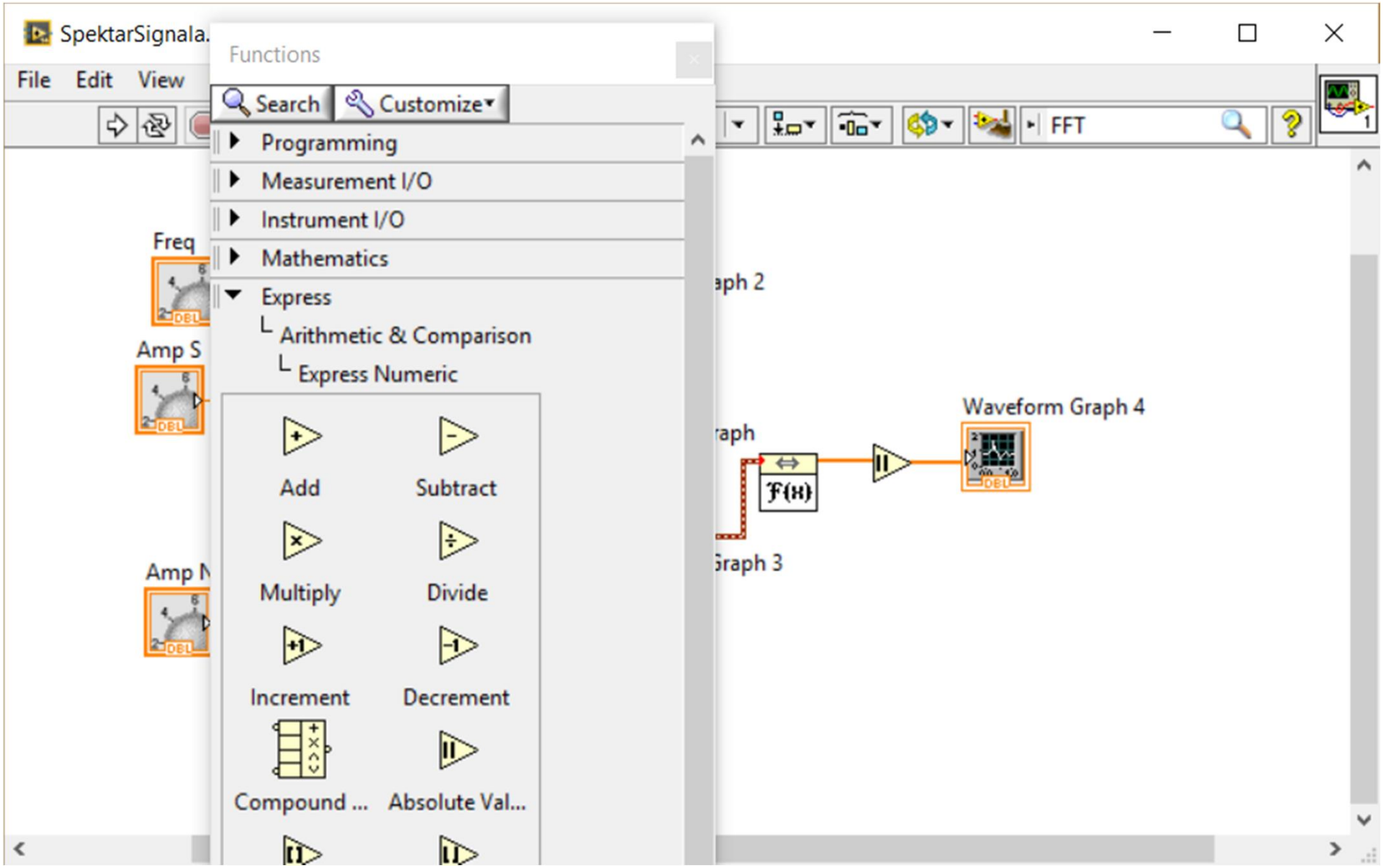

NI_MABase.lvlib:Triangle Waveform.vi:3970001 (clone)
File Edit View Project Operate Tools Window Help
frequency
10.00
amplitude
1.00
phase
0.00
offset
0.00
reset signal
OFF
signal out
t0
00:00:00 PM
MM/DD/YYYY
dt
1.00
Y
0
0
0
0
0
0
error in (no error)
status
code
0
source
sampling info
Fs
1.00k
#s
1000
error out
status
code
0
source

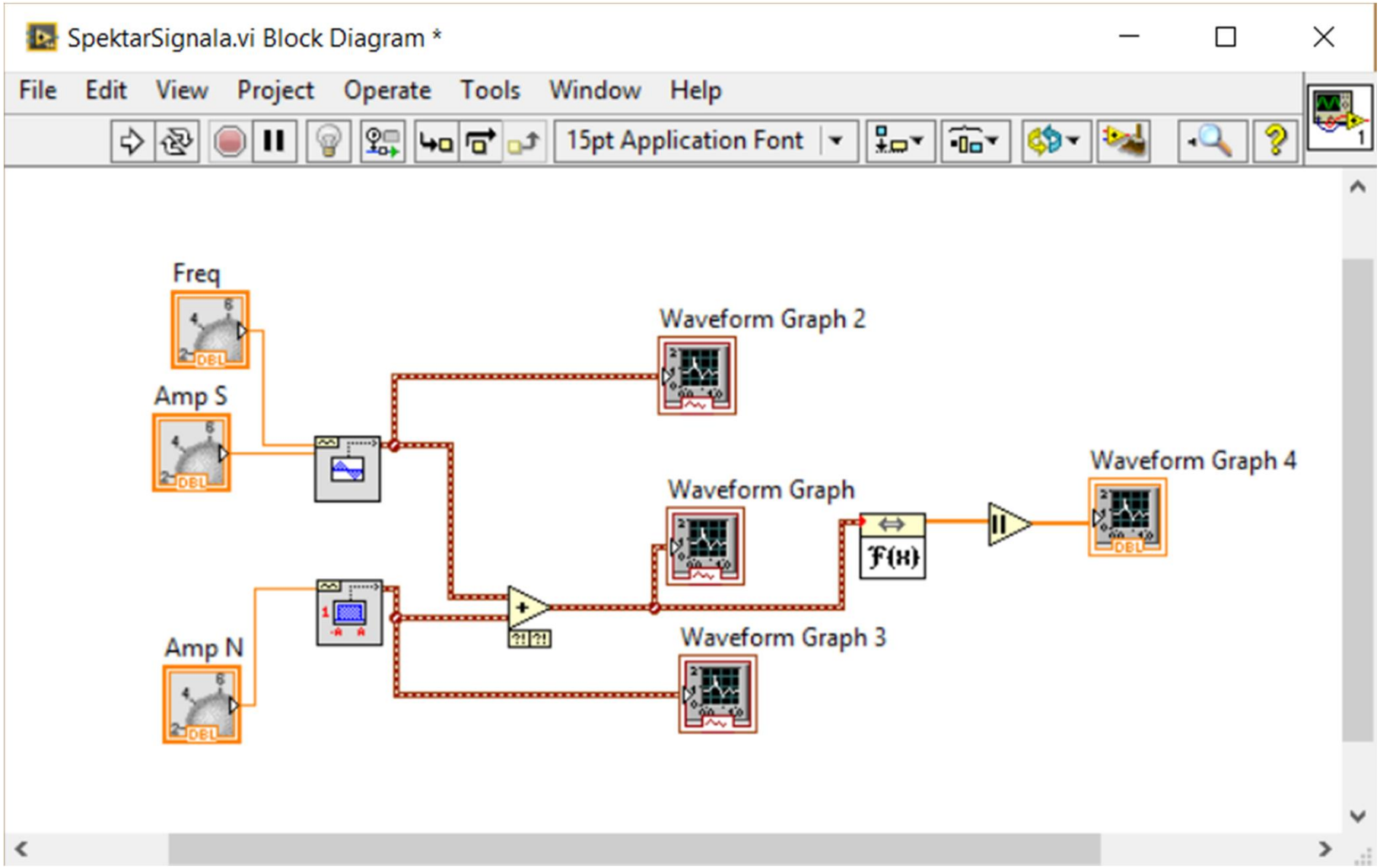

NI_MABase.lvlib:Uniform White Noise Waveform.vi:2810001 (clone)
File Edit View Project Operate Tools Window Help
amplitude
1.00
seed
-1
reset signal
OFF
signal out
t0
00:00:00 PM
MM/DD/YYYY
dt
1.00
Y
0
0
0
0
0
0
sampling info
Fs
1.00k
#s
1000
error in (no error)
status
code
0
source
error out
status
code
0
source

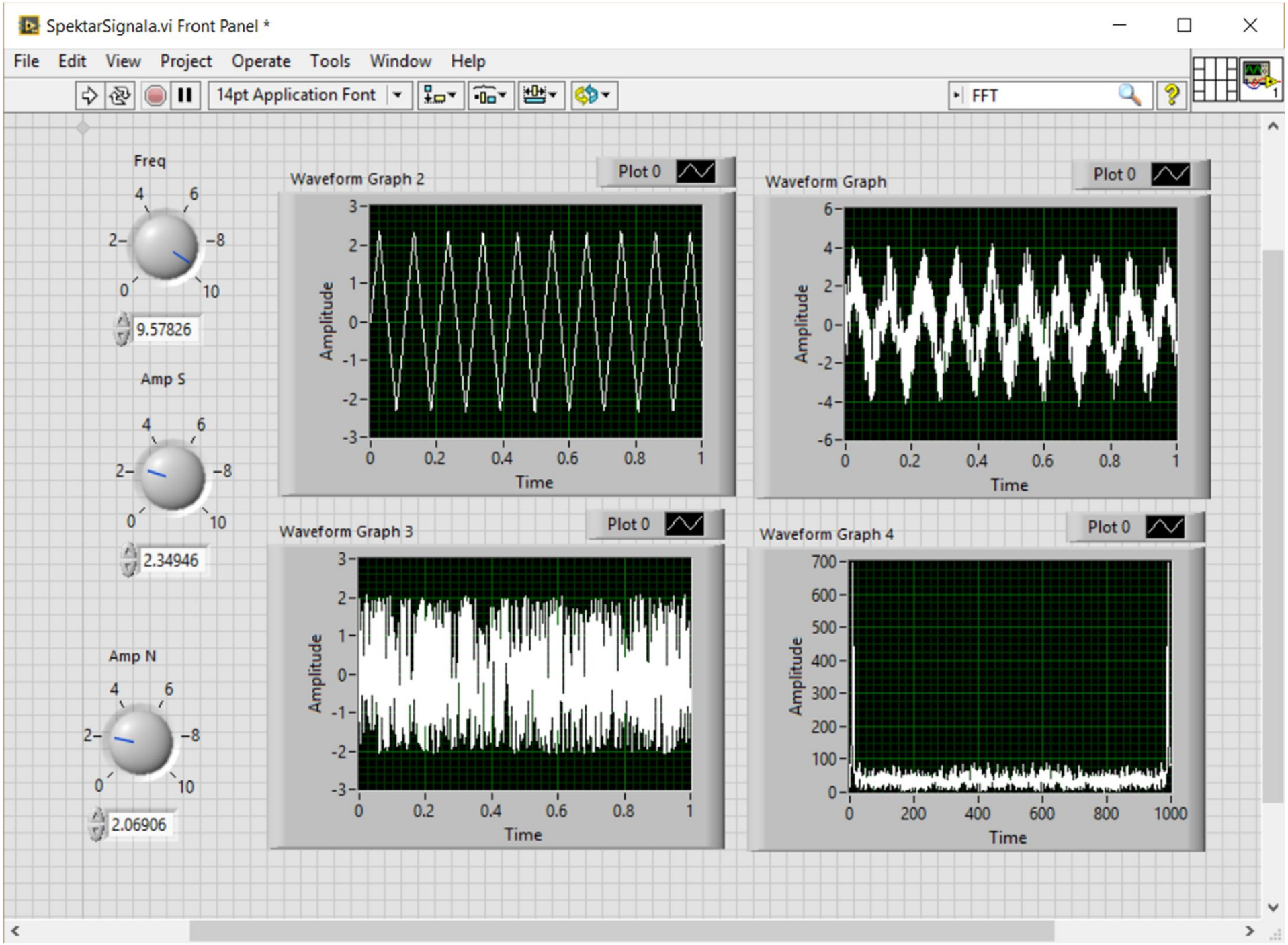

spectrumExample.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Power Spectrum.vi
Frequency
Sine Waveform.vi
Sine Waveform
Amplitude
Sine Waveform 2
Uniform White Noise Waveform.vi
Noise Waveform
Amplitude
1
Add
S+N Waveform
FFT

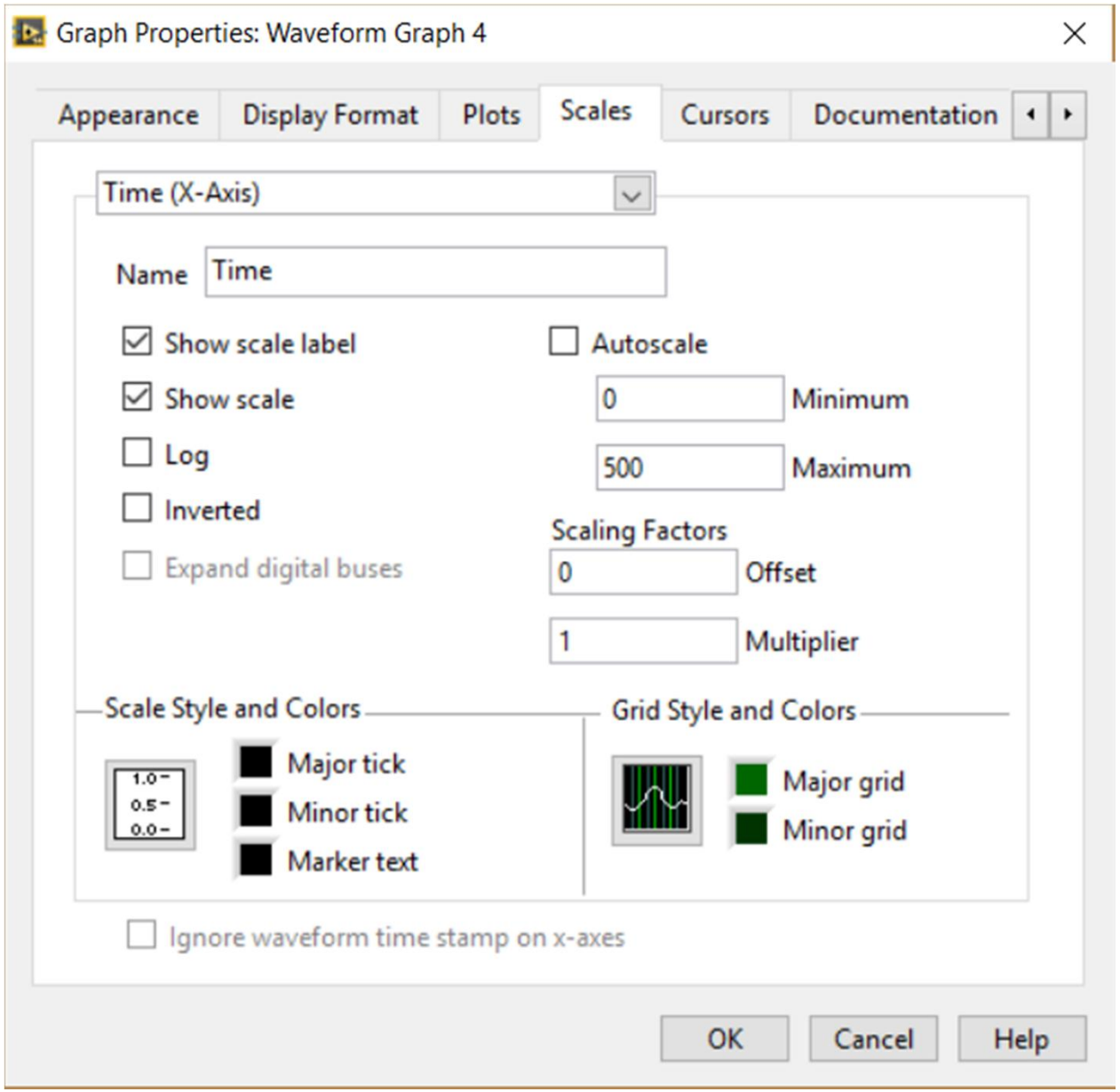

LabVIEW Help
Hide
Locate
Back
Forward
Options
Contents
Index
Type in the word(s) to sear
Add Waveform
List Topics
Select topic:
Found: 0
Title
Locat
Search previous results
Match similar words
Search titles only
FFT VI
Owning Palette: Transforms VIs
Requires: Full Development System
Computes the fast Fourier transform (FFT) of the input sequence X. Wire data to the X input to determine the polymorphic instance to use or manually select the instance.
Details
Example
Use the pull-down menu to select an instance of this VI.
Select an instance
Add to the block diagram
Find on the palette
Real FFT
X
shift?
FFT size
FFT {X}
error
X is a real vector.
shift? specifies whether the DC component is at the center of FFT {X}. The defau
is FALSE.
FFT size is the length of the FFT you want to perform. If FFT size is greater than
the number of elements in X, this VI adds zeros to the end of X to match the size
FFT size. If FFT size is less than the number of elements in X, this VI uses only
the first n elements in X to perform the FFT, where n is FFT size. If FFT size is
less than or equal to 0, this VI uses the length of X as the FFT size.
FFT {X} is the FFT of X.
error returns any error or warning from the VI. You can wire error to the Error
Cluster From Error Code VI to convert the error code or warning into an error
cluster.
Complex FFT
shift?

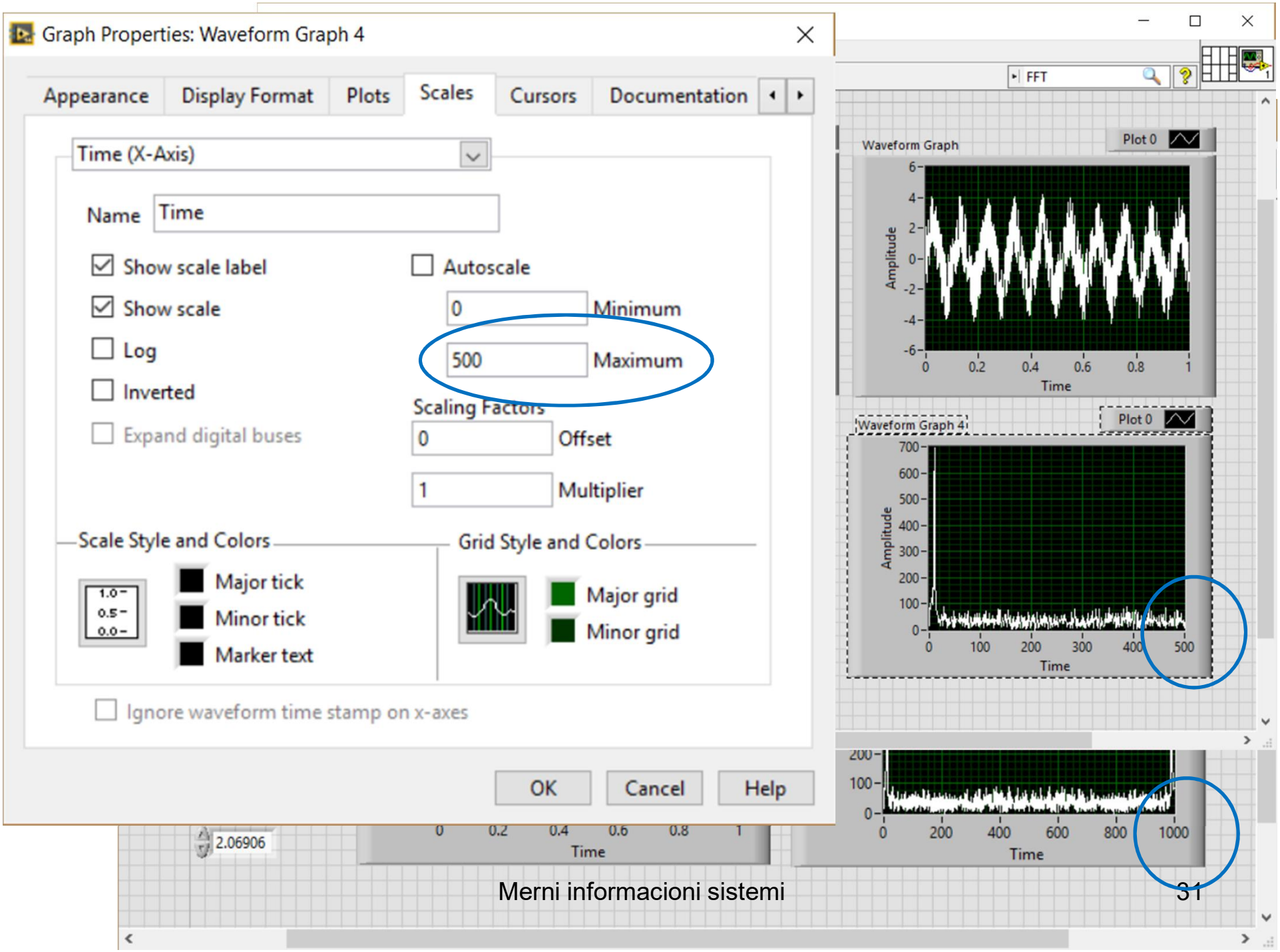

SpektarSignala.vi Block Diagram *
File Edit View Project Operate Tools Window Help
15pt Application Fo
Freq
Amp S
Amp N
Waveform
Waveform
Waveform
Functions
Search
Customize
Programming
Measurement I/O
Instrument I/O
Mathematics
Express
Signal Processing
Transforms
FFT
Fast Hilbert
FHT
WvltDaubchi...
Walsh Hadm...
DCT
DST
Chirp Z

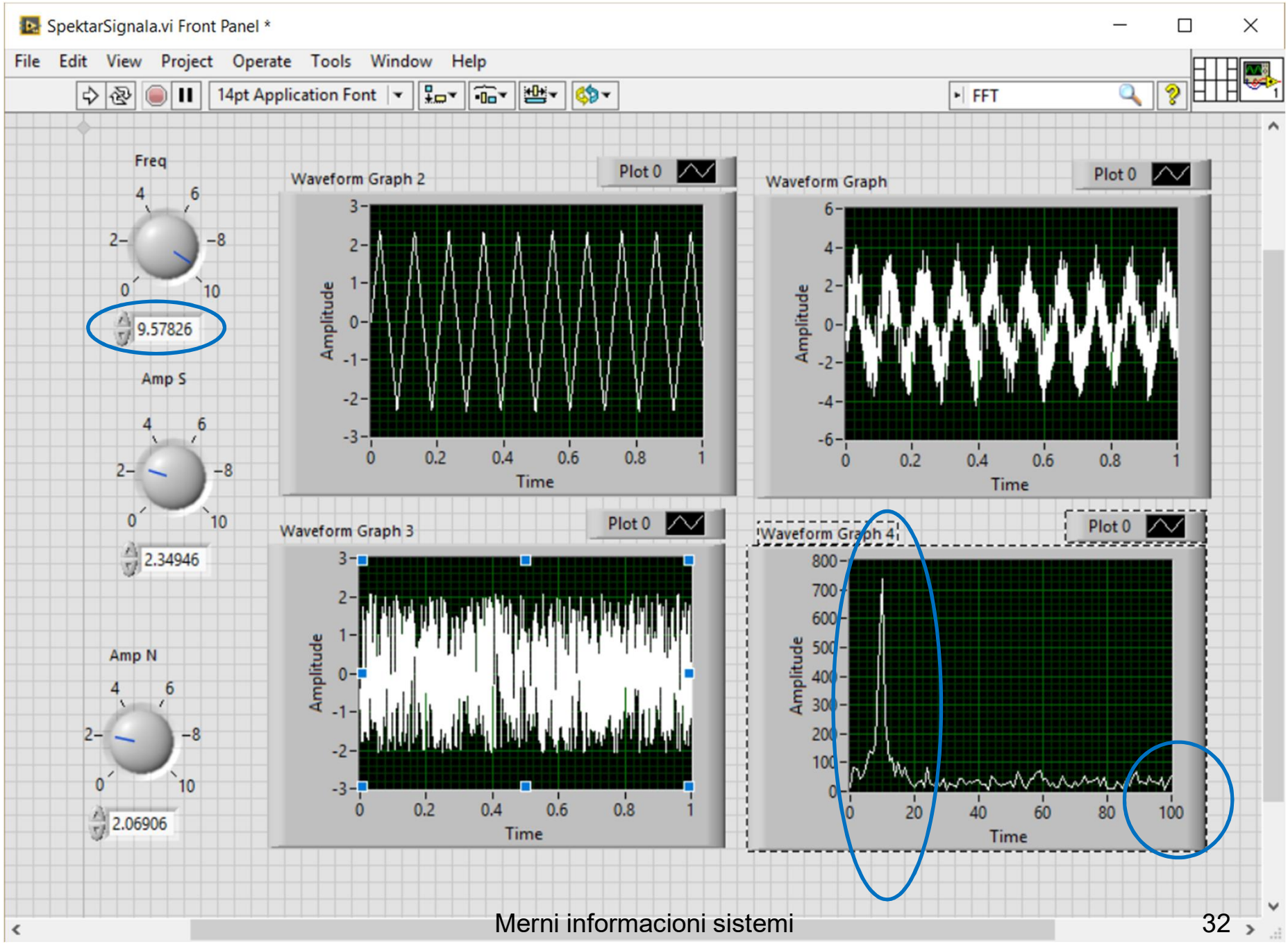

SpektarSignala.
File Edit View
Functions
Search
Customize
Programming
Measurement I/O
Instrument I/O
Mathematics
Express
Arithmetic & Comparison
Express Numeric
Add
Subtract
Multiply
Divide
Increment
Decrement
Compound ...
Absolute Val...
FFT
Freq
Amp S
Amp N
Waveform Graph 4
F(x)

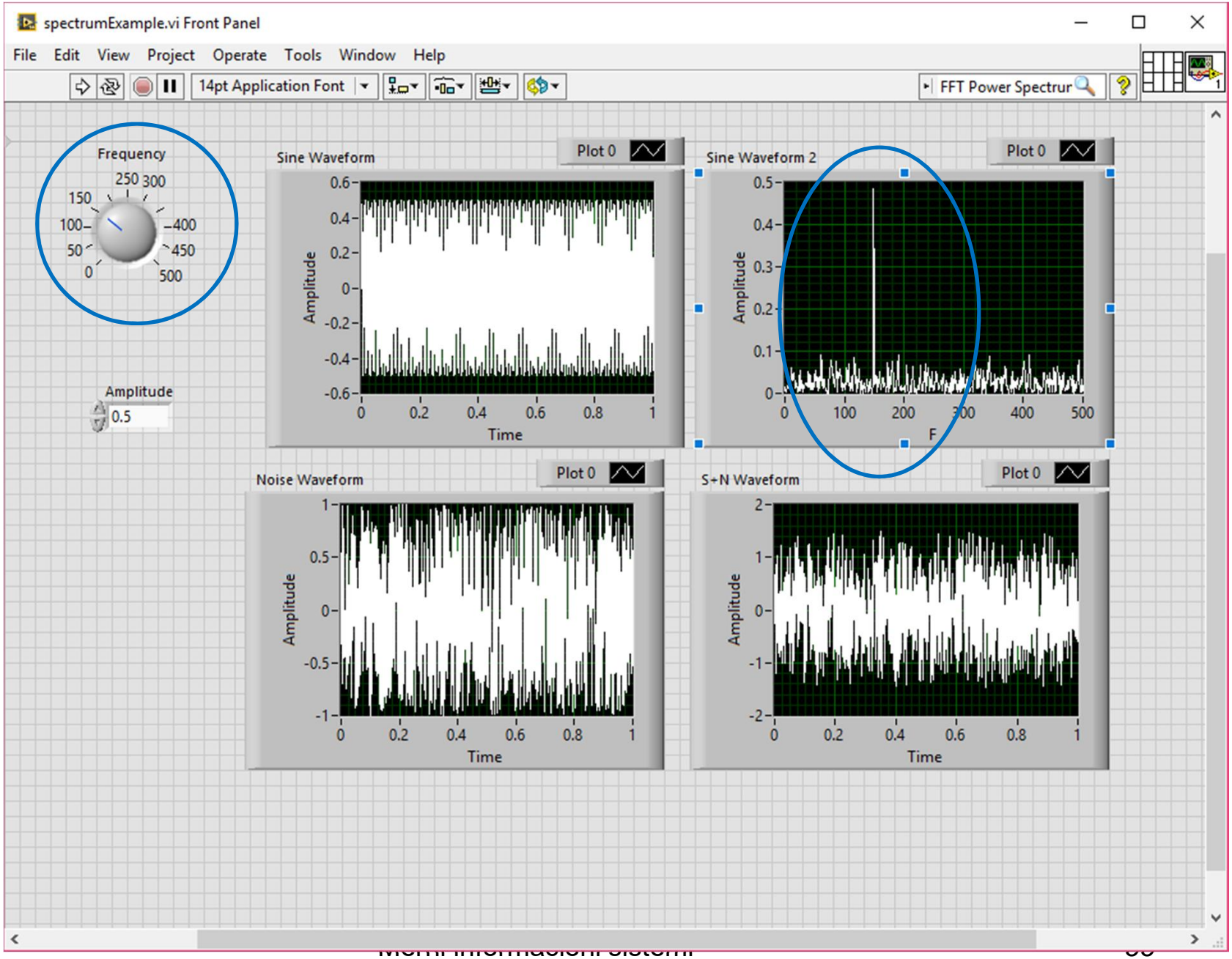

SpektarSignala.vi Block Diagram *
File Edit View Project Operate Tools Window Help
15pt Application Font
Freq
Amp S
Amp N
Waveform Graph 2
Waveform Graph
Waveform Graph 3
Waveform Graph 4
F(x)


SpektarSignala.vi Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
FFT
Freq
9.57826
Amp S
2.34946
Amp N
2.06906
Waveform Graph 2
Plot 0
Amplitude
Time
Waveform Graph
Plot 0
Amplitude
Time
Waveform Graph 3
Plot 0
Amplitude
Time
Waveform Graph 4
Plot 0
Amplitude
Time


Graph Properties: Waveform Graph 4
Appearance
Display Format
Plots
Scales
Cursors
Documentation
Time (X-Axis)
Name
Time
Show scale label
Show scale
Log
Inverted
Expand digital buses
Autoscale
0
Minimum
500
Maximum
Scaling Factors
0
Offset
1
Multiplier
Scale Style and Colors
1.0
0.5
0.0
Major tick
Minor tick
Marker text
Grid Style and Colors
Major grid
Minor grid
Ignore waveform time stamp on x-axes
OK
Cancel
Help


Graph Properties: Waveform Graph 4
Appearance
Display Format
Plots
Scales
Cursors
Documentation
Time (X-Axis)
Name
Time
Show scale label
Show scale
Log
Inverted
Expand digital buses
Autoscale
0
Minimum
500
Maximum
Scaling Factors
0
Offset
1
Multiplier
Scale Style and Colors
Major tick
Minor tick
Marker text
Grid Style and Colors
Major grid
Minor grid
Ignore waveform time stamp on x-axes
OK
Cancel
Help
FFT
Waveform Graph
Plot 0
Amplitude
Time
Waveform Graph 4
2.06906


SpektarSignala.vi Front Panel *
File Edit View Project Operate Tools Window Help
14pt Application Font
FFT
Freq
9.57826
Amp S
2.34946
Amp N
2.06906
Waveform Graph 2
Plot 0
Amplitude
Time
Waveform Graph
Plot 0
Amplitude
Time
Waveform Graph 3
Plot 0
Amplitude
Time
Waveform Graph 4
Plot 0
Amplitude
Time


spectrumExample.vi Front Panel
File Edit View Project Operate Tools Window Help
14pt Application Font
FFT Power Spectrur
Frequency
250 300
150
100
50
0
400
450
500
Amplitude
0.5
Sine Waveform
Plot 0
Amplitude
Time
Sine Waveform 2
Plot 0
Amplitude
F
Noise Waveform
Plot 0
Amplitude
Time
S+N Waveform
Plot 0
Amplitude
Time

Profesor dr Miroslav Lutovac
mlutovac@viser.edu.rs