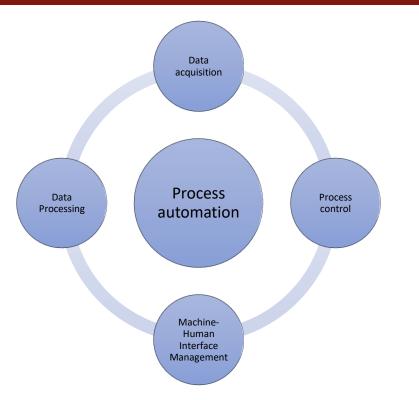


LABVIEW AN INTRODUCTION

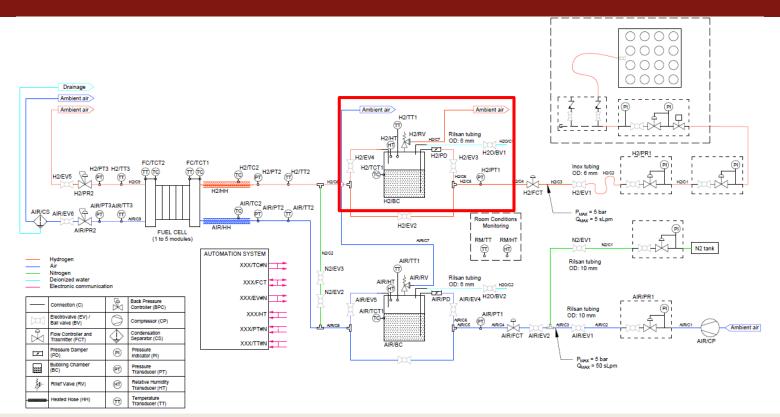
Prof. Marco Bogar

A.A. 2023-2024

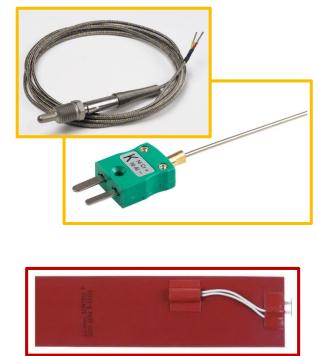
INTRODUCTION

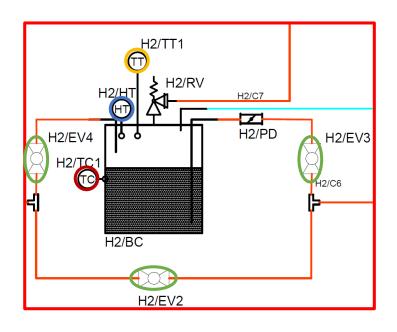








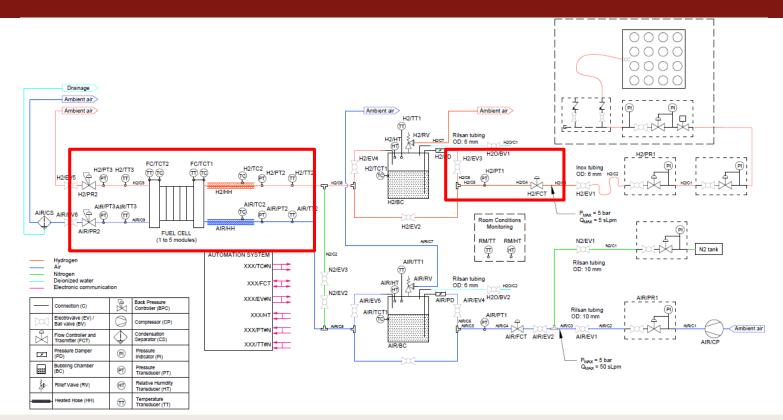




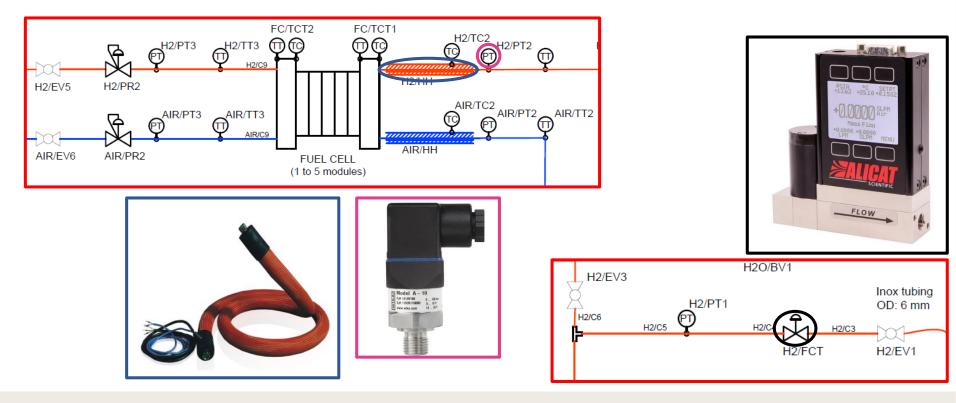




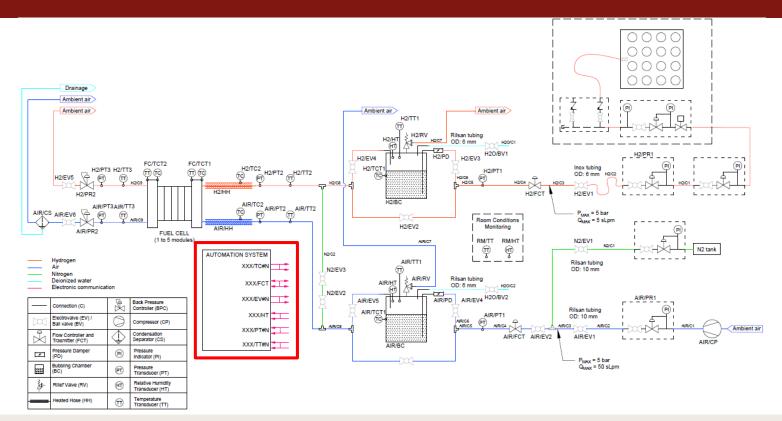




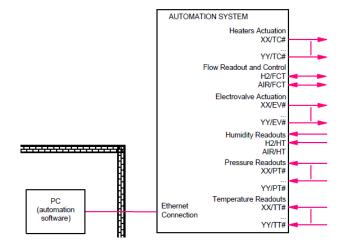












To relays

Digital communication (ETH, RS-232, RS-485, ...)

Digital output

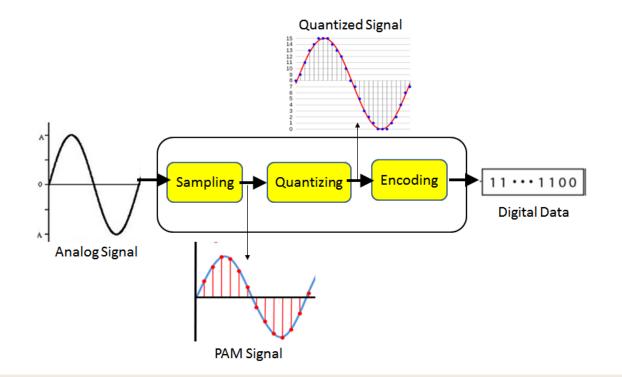
Analogue voltage input

Analogue current input (power supply to be externally provided)

Differential voltage input



DATA ACQUISITION / ADC







Programmable Logic Controller

- Short response time
- Suitable for operating in harsh environments
- Easy connection system and programming language

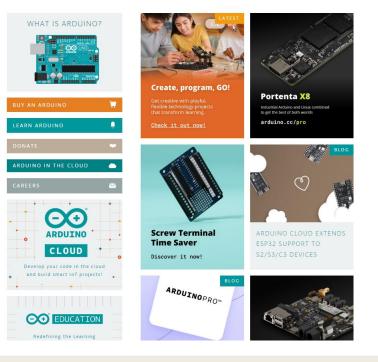


ARDUINO

PROFESSIONAL EDUCATION STORE

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HARDWARE SOFTWARE CLOUD DOCUMENTATION - COMMUNITY BLOG ABOUT



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Q Search on Arduino.cc SIGN IN

() Help

ARDUINO

Boards



Shields



ReadAnalogVoltage | Arduino 1.8.19
File Modifica Sketch Strumenti Aiuto



ReadAnalogVoltage

Reads an analog input on pin 0, converts it to voltage, and prints the result to the Serial Monitor. Graphical representation is available using Serial Plotter (Tools > Serial Plotter menu). Attach the center pin of a potentiometer to pin $\lambda 0$, and the outside pins to +5V and ground.

This example code is in the public domain.

```
https://www.arduino.cc/en/Tutorial/BuiltInExamples/ReadAnalogVoltage
```

```
// the setup routine runs once when you press reset:
```

void setup() {

// initialize serial communication at 9600 bits per second: Serial.begin(9600);

```
// the loop routine runs over and over again forever:
```

```
void loop() {
```

1

1

```
// read the input on analog pin 0:
```

```
int sensorValue = analogRead(A0);
```

```
// Convert the analog reading (which goes from 0 - 1023) to a voltage (0 - 5V):
```

```
float voltage = sensorValue * (5.0 / 1023.0);
```

```
// print out the value you read:
```

```
Serial.println(voltage);
```



PXI

Meet demanding test objectives with the widest portfolio of industry-leading modular instruments and configurable software interfaces.



LabVIEW

Create applications using an intuitive graphical programming language with unparalleled hardware connectivity and extensive IP libraries.



DAQ Products

Explore data acquisition products with sensor-specific, conditioned I/O for accurate and precise measurements.





PXI

Meet demanding test objectives with the widest portfolio of industry-leading modular instruments and configurable software interfaces.



What is PXI?

NI PXI systems provide high-performance modular instruments and other I/O modules that feature specialized synchronization and key software features for test and measurement applications from device validation to automated production test. NI is the PXI industry leader, with the broadest array of best-in-class products and services on the market.



WATCH THE VIDEO





PXI

Meet demanding test objectives with the widest portfolio of industry-leading modular instruments and configurable software interfaces.

Controller

PXI controllers are either integrated or remote. Integrated controllers contain everything you need to run your PXI system without an external PC, while remote controllers let you control your PXI system from desktops, laptops, or server computers.

View PXI controllers





Modules

NI offers more than 600 PXI modules that acquire data, trigger and synchronize devices, generate and route signals, and make a variety of measurements ranging from DC to mmVave. Also, the PXI portfolio includes modular instruments—such as oscilloscopes and digital multimeters—that can replace traditional box instruments and with which you can integrate PXI switches in a variety of topologies. Because PXI is an open industry standard, nearly 1,500 products are available from more than 70 different instrument vendors.

PXI Multifunction I/O Module

Device for PXI Remote Control

PXI Digital Multimeter

 \rightarrow

neter

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PXI Digital I/O Module





PXI

Meet demanding test objectives with the widest portfolio of industry-leading modular instruments and configurable software interfaces.



Chassis

The chassis—the PXI system backbone—is comparable to a desktop PC's mechanical enclosure and motherboard. It provides power, cooling, and a communication bus to the system, and supports multiple instrumentation modules within the same enclosure. PXI uses commercial PC-based PCI and PCI Express bus technology while combining rugged CompactPCI modular packaging, as well as key timing and synchronization features. Chassis range in size from four to 18 slots to fit the needs of any application, whether you require a portable, benchtop, rack-mount, or embedded system.







PXI

Meet demanding test objectives with the widest portfolio of industry-leading modular instruments and configurable software interfaces.



NI led the creation of the PXI standards body to create an open standard, so you can augment your NI system with specialty modules from up to 60 other vendors.



NI PXI hardware utilizes the latest technology, incorporating powerful multicore processors, FPGAs, and other technology to increase measurement range and performance.





PXI's architecture makes it possible to synchronize measurements across multiple modules or multiple chassis, so you can add to your systems as requirements change.



PXI offers some of the highest frequency and accuracy specifications, so you can ensure your test systems deliver the production test results you need.



DAQ Products

Explore data acquisition products with sensor-specific, conditioned I/O for accurate and precise measurements.



Data Acquisition (DAQ)

Create DAQ systems with NI devices, sensors, and software.

What is DAQ?

Data acquisition (DAQ) is the process of measuring an electrical or physical phenomenon, such as voltage, current, temperature, pressure, or sound. A DAQ system consists of sensors, DAQ measurement hardware, and a computer with programmable software.



Data Acquisition Basics and Technology WATCH_VIDEO



NATIONAL INSTRUMENTS CRIO











NATIONAL INSTRUMENTS DAQ PRODUCTS







CompactDAQ

Achieve electrical and physical measurements with a customizable, accurate, yet cost-effective way to conduct benchtop measurements. This portable, flexible approach is ideal for applications with a wide mix of measurement types, where scalability and flexibility are important. Hardware ruggedness makes it a great fit for highchannel-count distributed applications in the field.

CompactRIO

Take advantage of real-time data processing capabilities, sensorspecific conditioned I/O, and a closely integrated software toolchain for long-running, industrial data acquisition applications.



PXI

Use this modular approach for highchannel-count data acquisition and sensor measurement applications. Systems range from tens to hundreds of channels, mixing and matching measurement functionality and output capabilities.



DAQ Products

Explore data acquisition products with sensor-specific, conditioned I/O for accurate and precise measurements.



Maximize the absolute accuracy of your measurements with NI's industry-leading performance for automated data acquisition.



Build mixed-measurement systems tailored to your needs and swap out or add hardware as your needs change.



Scalable

Choose from hardware options that let you control multiple data acquisition systems as part of one synchronized application. Regrammable

Program your hardware with the same API in your choice of language, including G, Python, ANSI C, C#, and .NET. Or, use interactive software without writing code.



NATIONAL INSTRUMENTS LABVIEW

LabVIEW

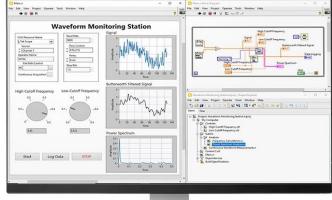
Create applications using an intuitive graphical programming language with unparalleled hardware connectivity and extensive IP libraries.



What Is LabVIEW?

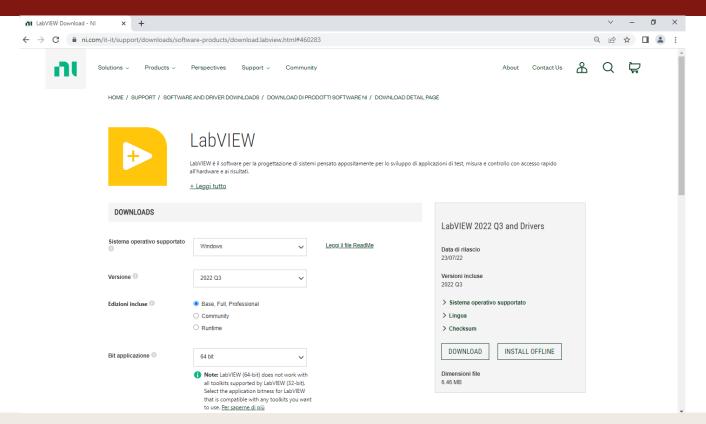
LabVIEW is a graphical programming environment engineers use to develop automated research, validation, and production test systems.















LABoratory Virtual Instruments Engineering Workbench

Graphical programming language that allows for:

- instrument control
- data acquisition
- pre/post data processing

Graphical programming language: graphical symbols rather than textual language to describe programming actions

Such a software was born in 1986: up to date embeds lots of libraries for communicate with most of the hardware available on the market.





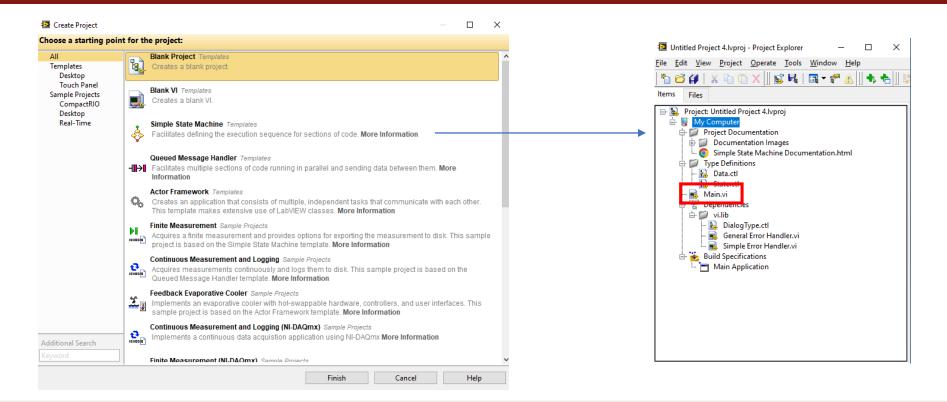
A program developed by means of LV is called Virtual Instrument (VI).

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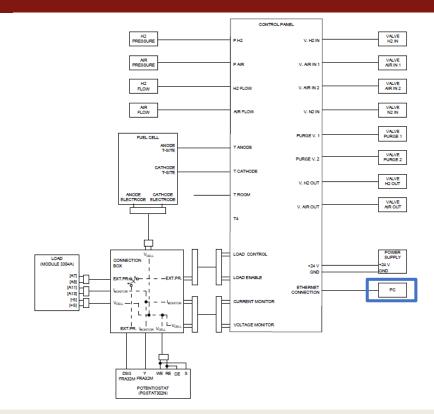






Main.vi Front Panel on Untitled Project 4.lvproj/My Computer × <u>File Edit View Project Operate Tools Window Help</u> Q 9 4 4 🗘 🛞 🛑 🖬 15pt Dialog Font 🛛 🗸 🖓 🐨 👘 🕇 😫 🗸 🥎 🔹 🔸 Search Do Something <Replace Me> These controls have associated "Value Changed" events configured in the Event Structure on the diagram. Something Do Something Else <Replace Me> Replace them (and reconfigure the Event Structure) with the controls you need for your application. Something Else This template is for the Simple State Machine design pattern. See the block diagram for more information on how to use this Main.vi Block Diagram on Untitled Project 4.lvproj/My Computer template. File Edit View Project Operate Tools Window Help 수 🛞 🔲 🛯 💡 👷 🏎 🖬 🛹 15pt Application Font 💌 🏪 🖓 🗸 🛀 Search Stop Button Stop * "Initialize" Code Needed - Add code to initialize your user interface here. Untitled Project 4.lvproj/My Computer < Dan Untitled Project 4.lvproj - Project Explorer -× This shift register File Edit View Project Operate Tools Window Help stores the data F----- Boolean <Replace Me> for the state | 🏠 😂 💋 | X 🖻 🕒 X || 🕵 尾 | 💷 - 🐔 🔥 || 🐟 😓 || machine Code Needed - Initialize your Items Files state data here. 🗄 💂 My Computer Project Documentation 🛛 💭 Documentation Images Initial State Next State - 0 Simple State Machine Documentation.html • Initialize 🔻 • Wait for Event 🔻 Type Definitions This shift registe - 🔝 Data.ctl stores the current - 🛃 Main.vi state 🗄 📁 🔽 vi.lib DialogType.ctl T 📕 General Error Handler.vi Simple Error Handler.vi Stop Loop? The state machine will GetHelpDir.vi V 🖲 stop if an error occurs. BuildHelpPath.vi If you want to handle LVBoundsTypeDef.ctl errors in a more Get String Text Bounds.vi This template is for the Simple State Machine design pattern. sophisticated way, Get Text Rect.vi consider adding an Convert property node font to graphics font.vi Each frame of this case structure executes code for its state and computes what state to transition to next. "Error" state that will Longest Line Length in Pixels.vi process errors that States are represented as values of an enumeration. These enumerations are instances of a type definition so that states can be R Three Button Dialog CORE.vi occur during other quickly added. To edit the type definition, right click on an enumeration and select Open Type Def. states. Three Button Dialog.vi DialogTypeEnum.ctl Not Found Dialog.vi Set Rold Text Untitled Project 4.lvproj/My Computer <

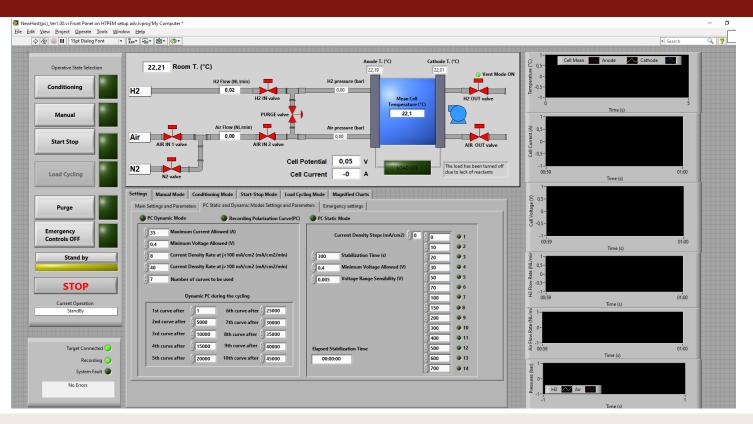




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- SVI Operative State Selection and Visualization.vi			
- 🔜 sVI Save Data on PC.vi			
– 🔜 sVI Plot Electrical Parameters.vi			
🔜 sVI Plot Gases Parameters.vi			
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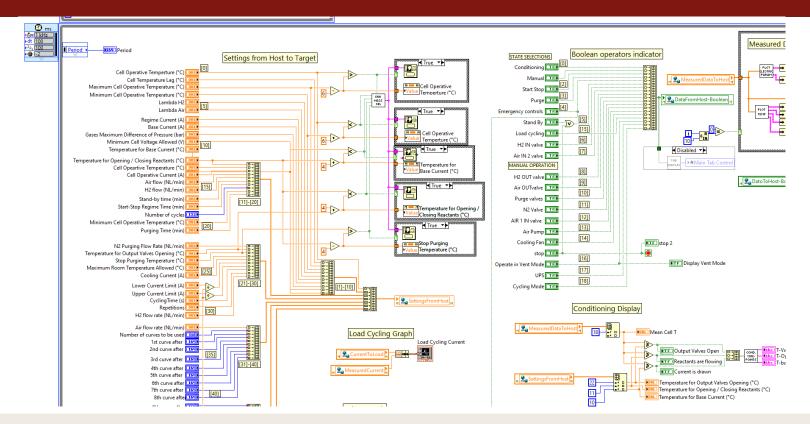


LABVIEW PROJECTS – A REAL EXAMPLE (1)

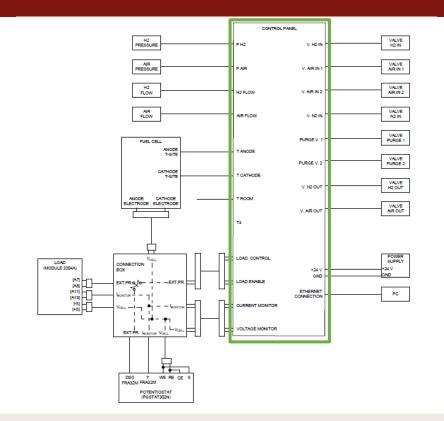




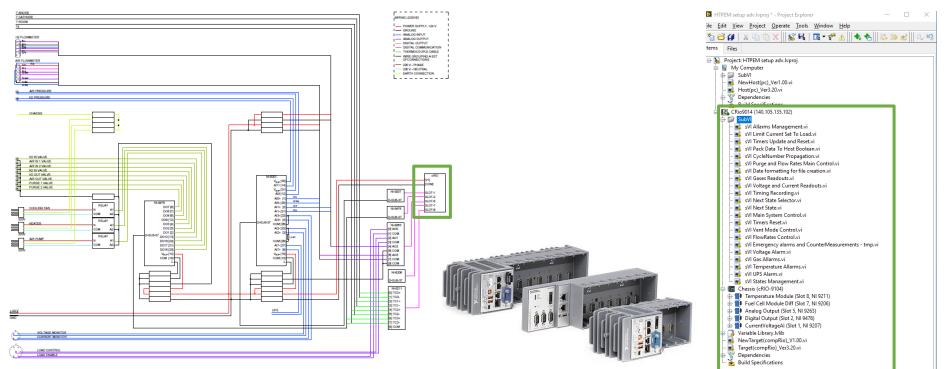
LABVIEW PROJECTS – A REAL EXAMPLE (1)





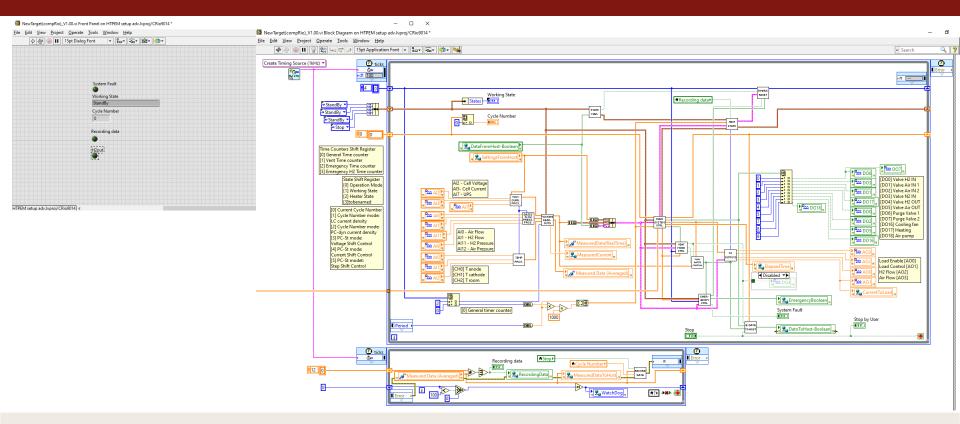




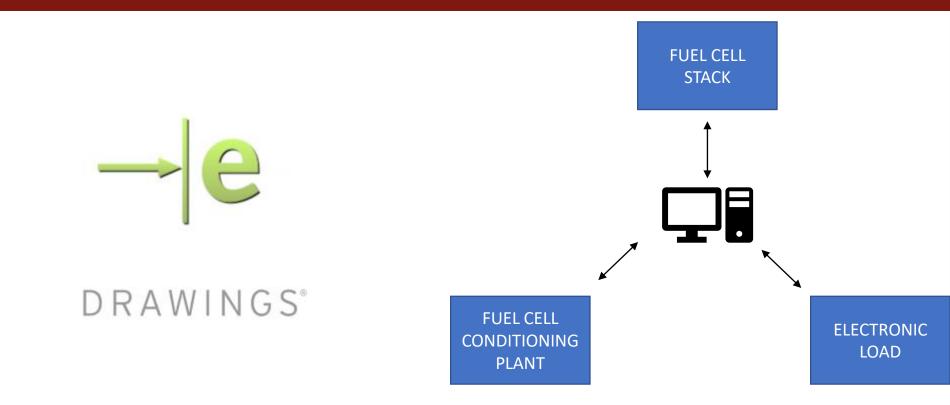


CONNECTOR VIEW FROM THE FRONT SIDE OF THE ENTRANCE PANEL CONNECTOR VIEW FROM THE FRONT PANEL OF THE INSTRUMENT

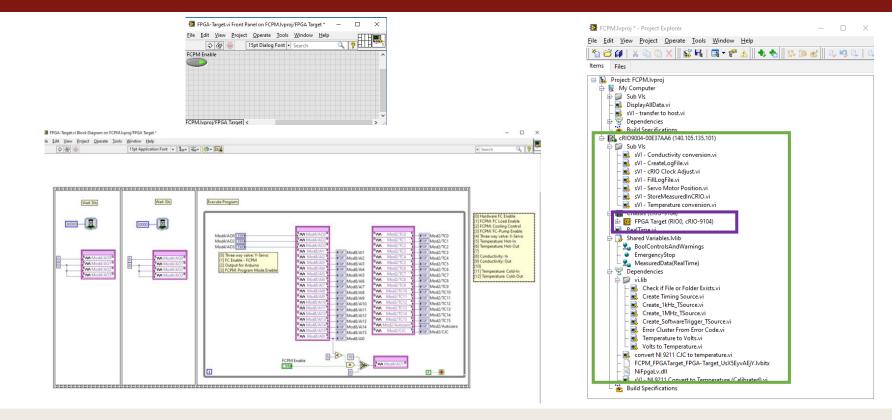






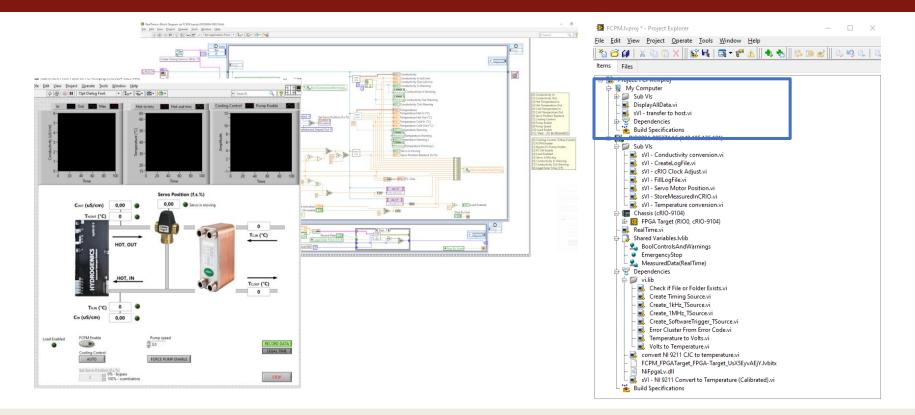








LABVIEW PROJECTS – ANOTHER EXAMPLE





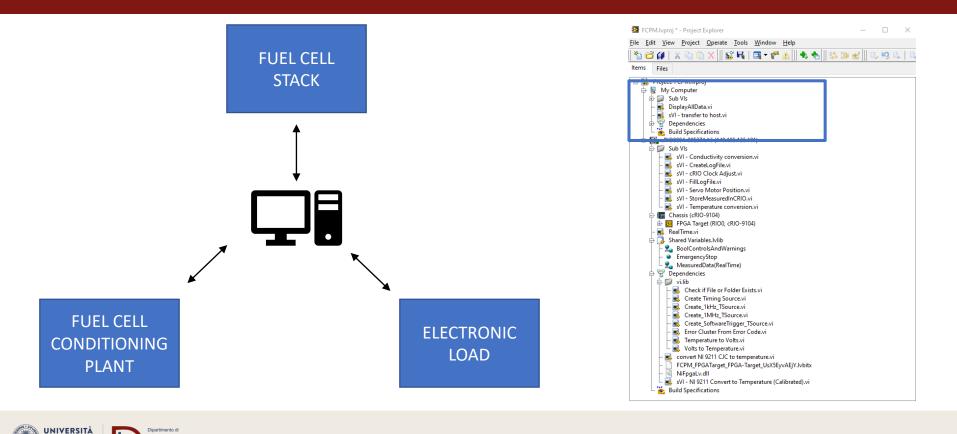
LABVIEW PROJECTS – ANOTHER EXAMPLE

DEGLI STUDI

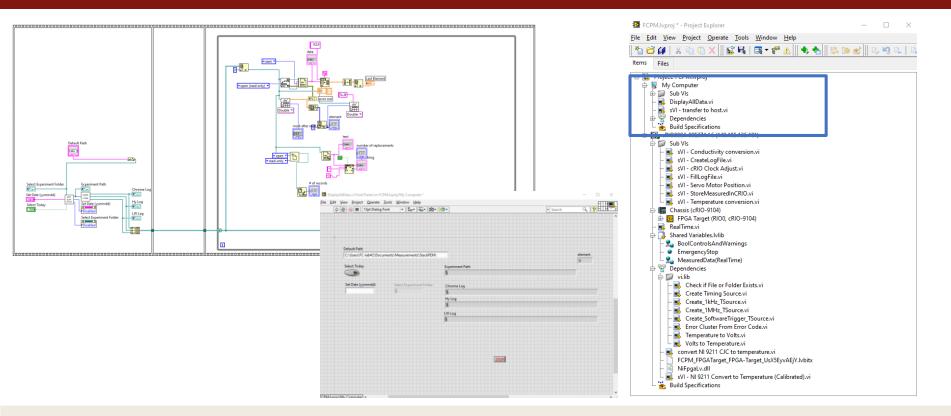
DITRIESTE

Ingegneria

e Architettura



LABVIEW PROJECTS – ANOTHER EXAMPLE





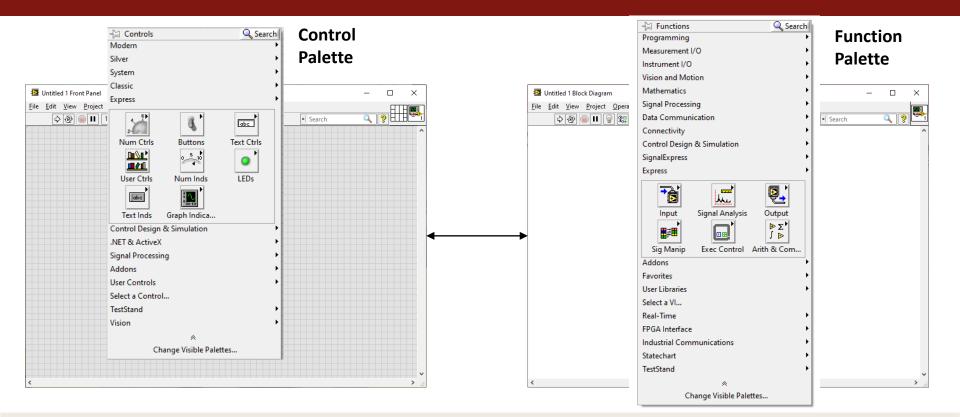
LABVIEW: INTO THE SOFTWARE

A program developed by means of LV is called Virtual Instrument (VI).

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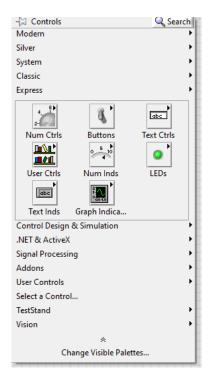


LABVIEW: INTO THE SOFTWARE



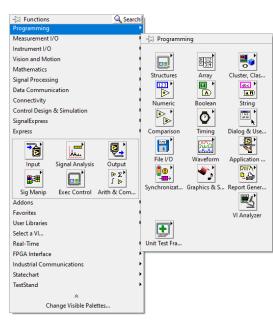
UNIVERSITÀ DEGLI STUDI DI TRIESTE

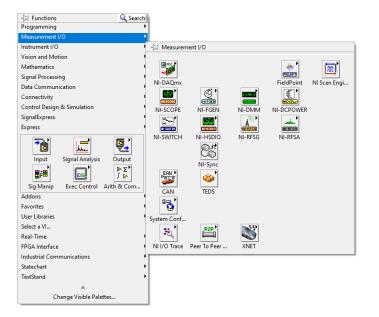
THE FRONT PANEL - THE CONTROL PALETTE

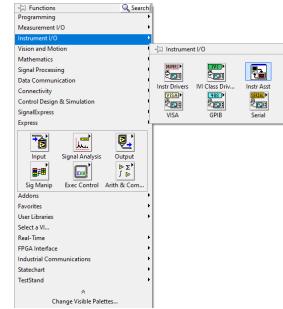




THE BLOCK DIAGRAM - THE FUNCTION PALETTE

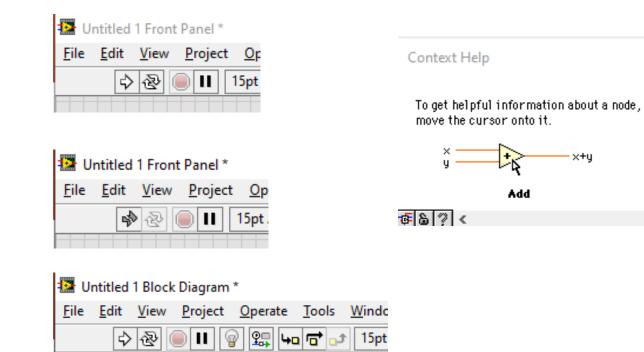








MAIN CONTROLS AND AUXILIARY TOOLS

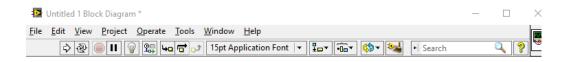


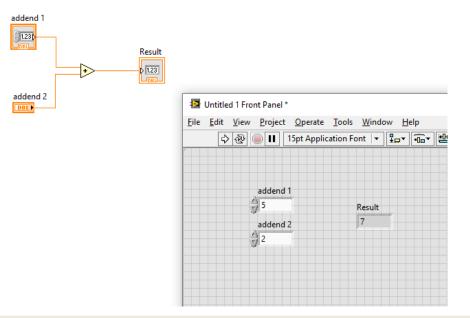


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ELEMENT DUALITY





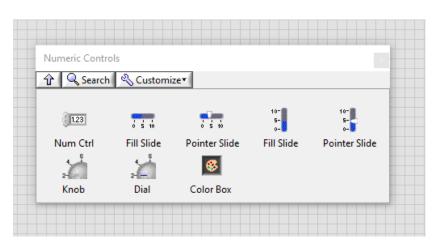


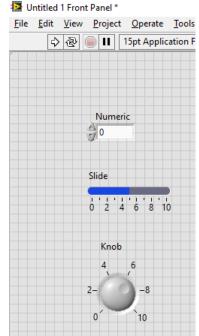
MAIN ELEMENTS FROM THE CONTROL PALETTE





NUMERIC CONTROLS















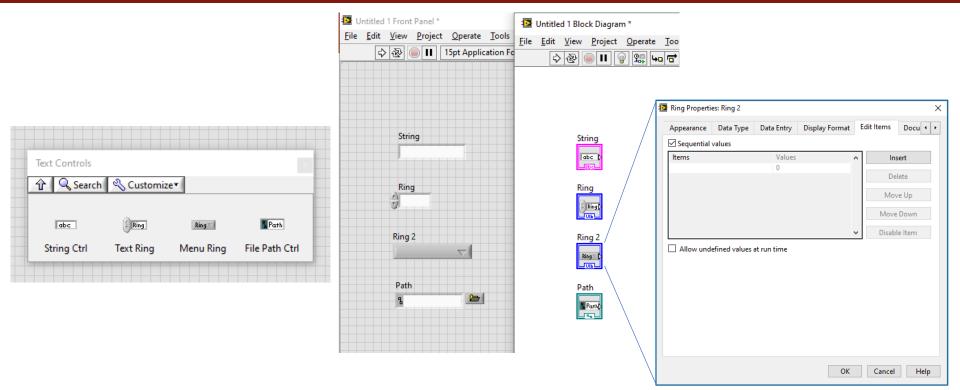
NUMERIC CONTROLS

Numeric Prop	erties: Nume	ric			>
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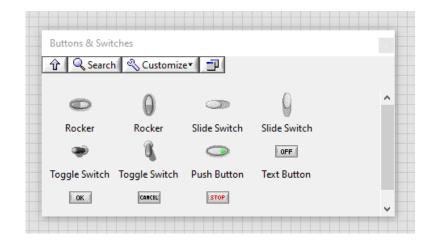


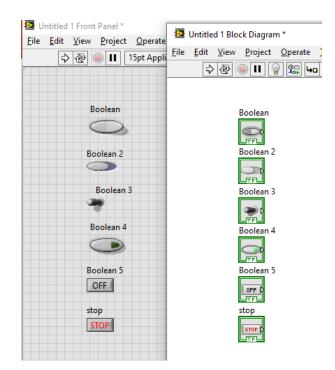
STRING CONTROLS





BOOLEAN CONTROLS

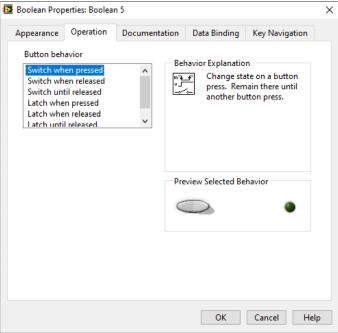






BOOLEAN CONTROLS

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Enabled State Enabled Disabled Disabled 8			ize leight Win 20	dth 39	
Colors		now Boolean text — Lock text in center			
On	On ON	text	Text o	color	
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BOOLEAN CONTROLS

Dipartimento di Ingegneria

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UNIVERSITÀ DEGLI STUDI

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😰 Boolean Properties: Boo	lean 5			×
Appearance Operatio	Documentation	Data Binding	Key Navigation	
Button behavior Switch when pressed Switch when released Switch until released Latch when pressed Latch when released Latch until released	^ _	press. Ren	n ate on a button nain there until itton press.	
	Pr	eview Selected Be	havior	
		ОК	Cancel He	lp

Button behavior

Switch when pressed Switch when released Switch until released Latch when pressed Latch when released Latch until released

Button behavior

Switch when pressed Switch when released Switch until released Latch when pressed Latch when released Latch until released

Button behavior

Switch when released Switch until released Latch when pressed Latch when released Latch until released

Behavior Explanation -



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Change state on a button press. Remain there until another button press.

Behavior Explanation



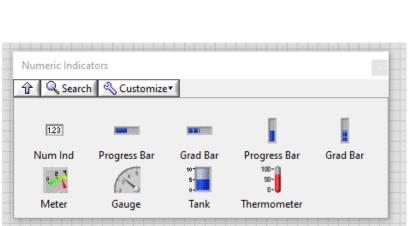
Change state on a button release. Remain there until another button release.

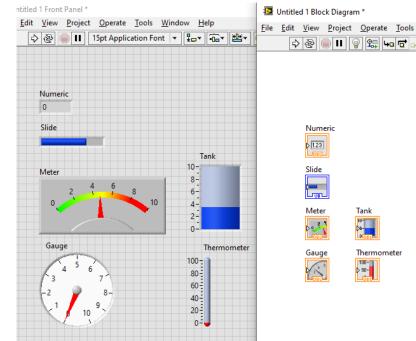
Behavior Explanation



Change state on a button press. Change back when released and read by LabVIEW.

NUMERIC INDICATORS

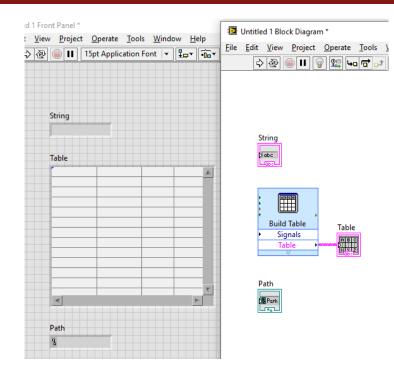






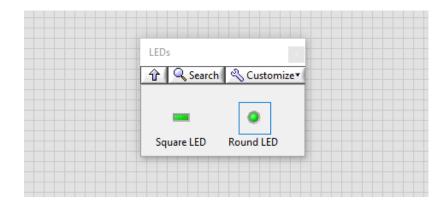
STRING INDICATORS

Text Indicators		
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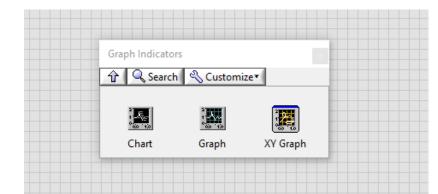
BOOLEAN INDICATORS

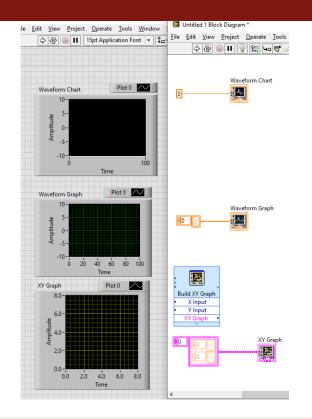


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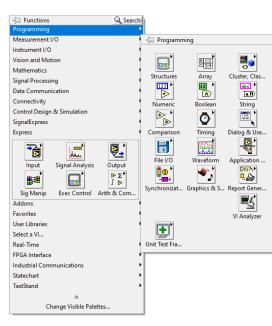
GRAPH INDICATORS

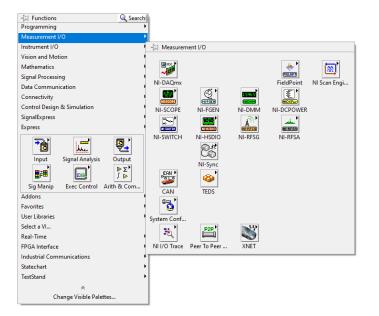


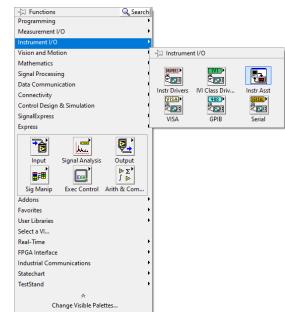




MAIN ELEMENTS FROM THE FUNCTION PALETTE

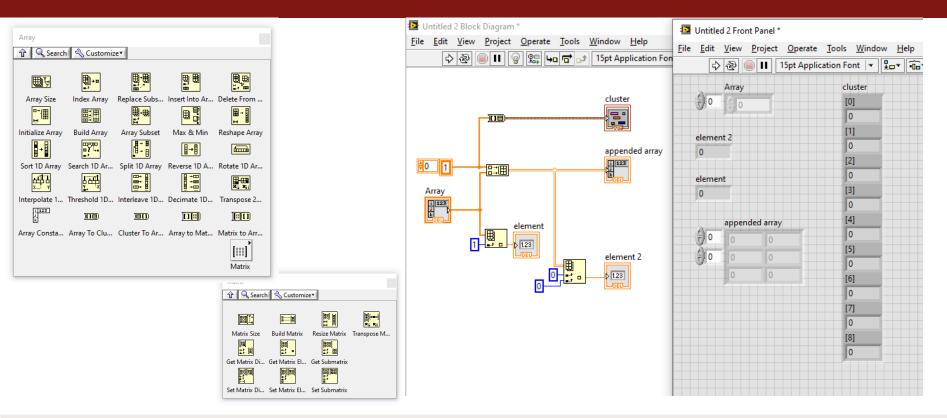








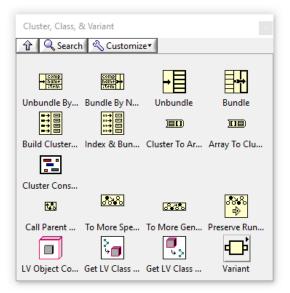
ARRAYS





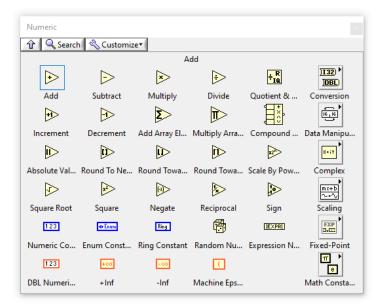
ARRAYS AND CLUSTERS

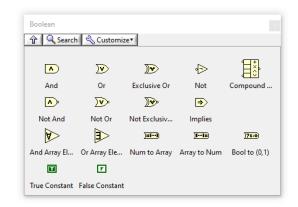
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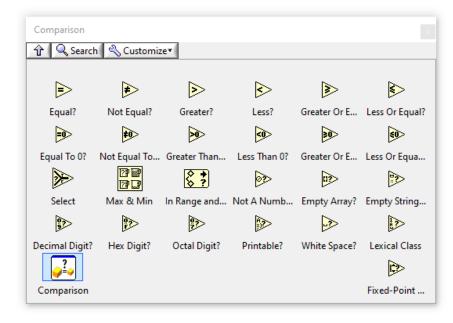
OPERATIONS

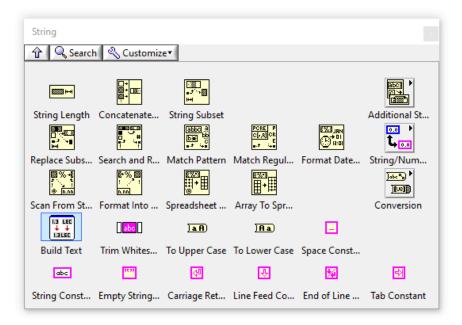






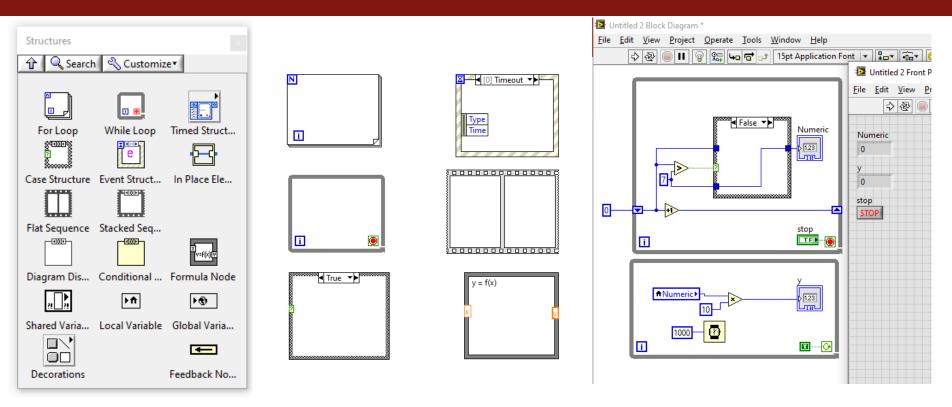
OPERATIONS





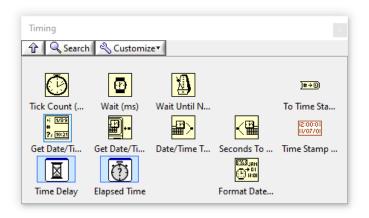


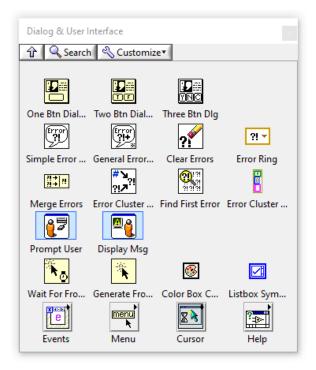
STRUCTURES





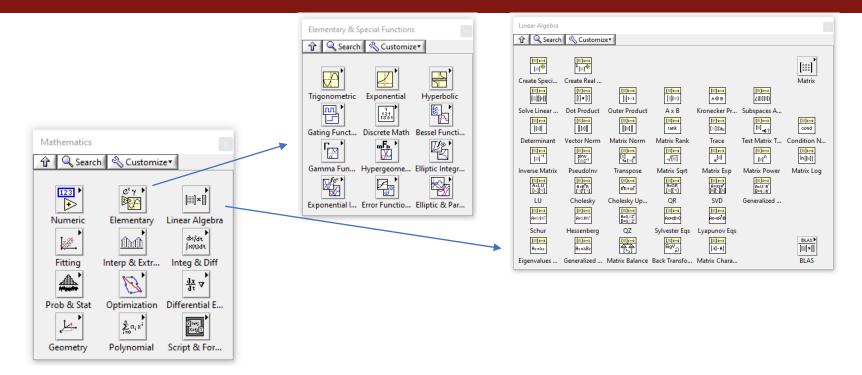
TIMING AND USER INTERFACE







MATHEMATICS

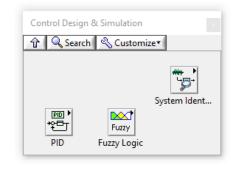




SIGNAL PROCESSING

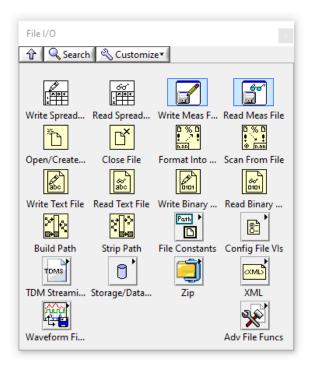
Signal Processi	ng		
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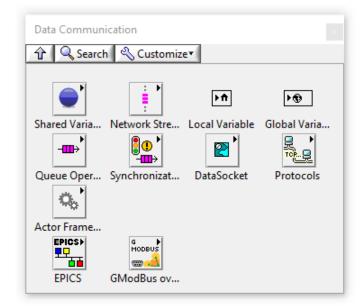
FILE I/O





COMMUNICATION

Instrument I/O	Serial	×
Instr Drivers IVI Class Driv Instr Asst VISA Extended Extended VISA GPIB Serial	Image: Second	ad Close







GRAPHICAL INTERFACE BASED BLOCKS







, <u> </u>	Configure Write To Measurement File [Write To Measurement File]	File] ×
Write To Measurement File	Filename C:\Users\Marco\Documents\LabVIEW Data\test.lvm	File Format Text (LVM) Binary (TDMS) Binary with XML Header (TDM) Lock file for faster access
Write To	 Save to one file Ask user to choose file Ask only once Ask each iteration If a file already exists 	Segment Headers One header per segment One header only No headers X Value (Time) Columns
Measurement File Comment DAQmx Task	Rename existing file Use next available filename Append to file Overwrite file	One column per channel One column only Empty time column Delimiter
Enable error in (no error Filename	O Save to series of files (multiple files) Settings	Tabulator Comma
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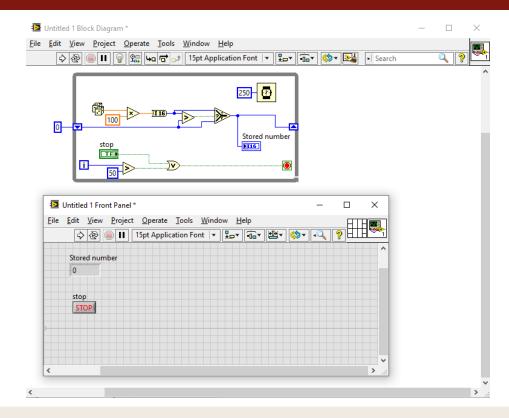
GRAPHICAL INTERFACE BASED BLOCKS



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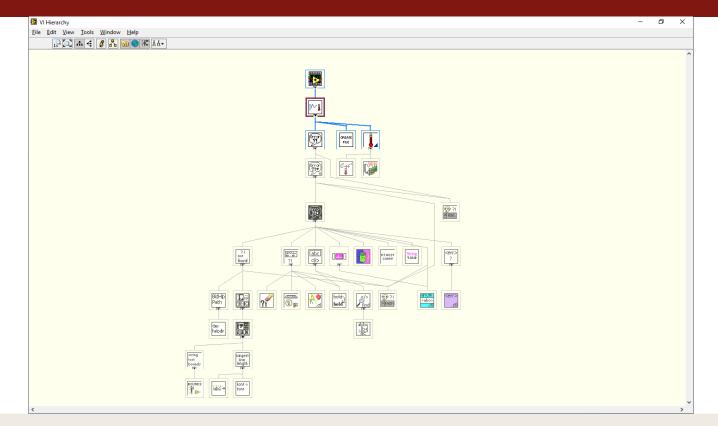
NI/ LABVIEW / VI / SOME EXAMPLES



- NI Example finder / Signal Processing / Advanced Peak Detection
- NI Example finder / Level Measurement / Advanced DC-RMS Measurement

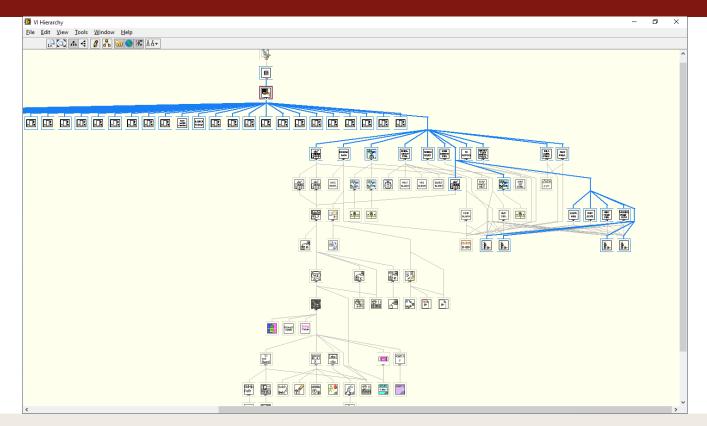


VI HIERARCHY





VI HIERARCHY

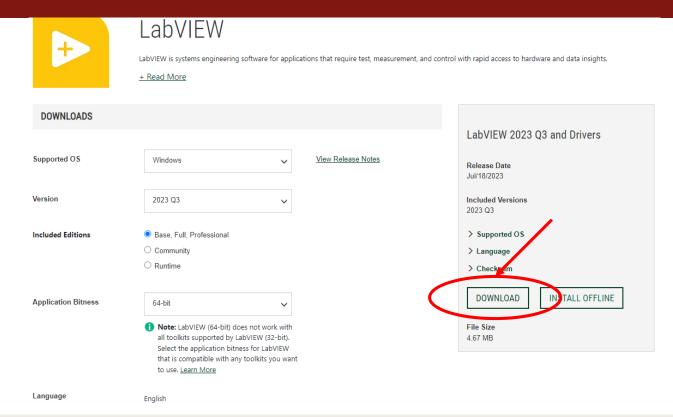




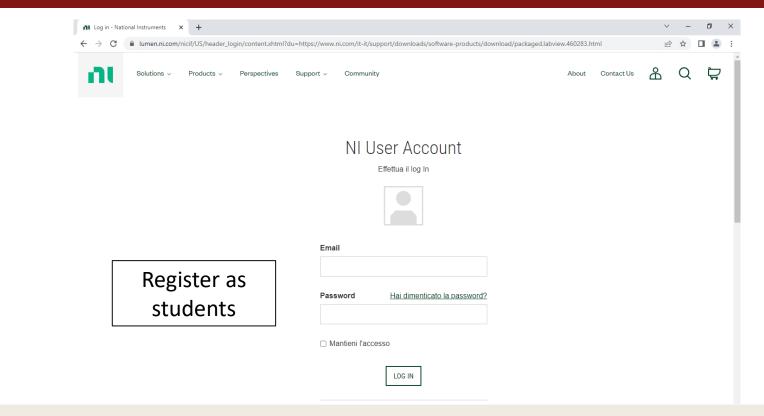
NI-MAX (MEASUREMENT & AUTOMATION EXPLORER)

 My System Data Neighborhood 	🔚 Save 🛛 🔁 Refresh			🥎 Hide H	Help
> Devices and Interfaces			^	G Back	
> 💋 Scales	System Settings			NI Measurement &	
> 🕤 Software > 🕅 IVI Drivers	Hostname	DESKTOP-KOJBKT6		Automation Explorer	
😫 Remote Systems	DNS Name	DESKTOP-KOJBKT6		Measurement & Automation Explorer (MAX) provides access	
	Vendor	Dell Inc.		to your NI products.	
	Model	Latitude E5410		What do you want to do?	
	Serial Number	C3960N1		Manage my devices and interfaces	
	Firmware Version	A07		Manage my installed NI	
	Hardware Revision	0001		software Manage virtual channels or	
	Operating System	Microsoft Windows 10 Enterprise		tasks for my devices	
	System Start Time	02/12/2022 17:27		Create scales for my virtual instruments	
	Description			Configure my IVI instrument drivers	
	System Configuration Web Access	Local Only ×		Import/export my device configuration file.	
	System Resources			Note Some categories are device specific. For example, the IVI category appears only if you have IVI installed.	
	Total Physical Memory	3.80 GB		For more information about	
	Free Physical Memory	627 MB		using MAX, select available help categories from the Help menu.	
	Total Virtual Memory	8.82 GB		If you need further assistance o want to know more about your)r
	Free Virtual Memory	1.61 GB		device, visit the NI Technical Support website.	
	Primary Disk Capacity	232 GB		For more information about this version of MAX, launch the	5
	Primary Disk Free Space	57.7 GB		readme or visit ni.com/info and enter the following Info Codes:	
	CPU Model	Intel(R) Core(TM) i7 CPU M 640 @ 2.80GHz		SysCfqFixList—	
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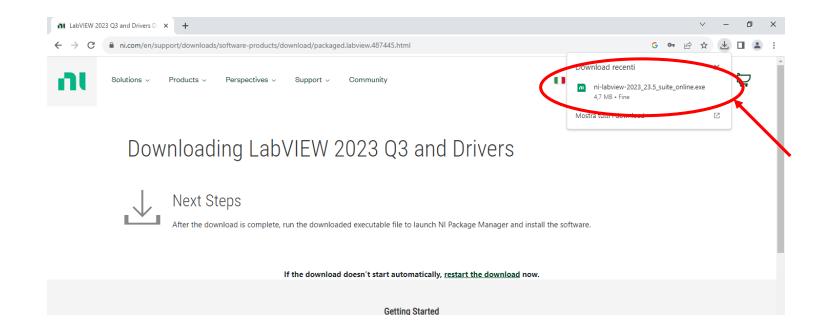




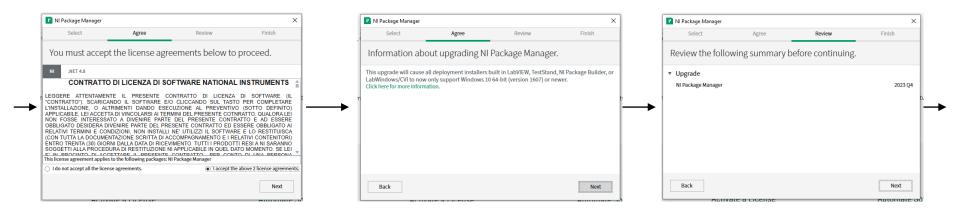














Select Agree		Review	Finish
PROGRAMMING ENVIRONMENTS	1	LabVIEW	and Drivers
✓ LabVIEW	2023 Q3	20011211	
G Web Development Software	2022 Q3		Orivers provides LabVIEW compatible NI driver
PLICATION SOFTWARE			software add-ons.
Switch Executive	2023 Q1		
DD-ONS			
LabVIEW Real-Time Module	2023 Q1		
LabVIEW FPGA Module	2023 Q1		
LabVIEW FPGA Compile Farm Toolkit	2023 Q1		
Vision Development Module	2023 Q1		
LabVIEW FPGA Compilation Tool for	2022 Q3		
RIVERS			
Industrial Controller Device Drivers	2023 Q1		
Select All Deselect All			Next

Select	Agree	Review	Finish
Additional item	s you may wish t	o install:	
JKI VI Package Man VI Package Manager hel	ager os you discover, create, and insta	ll LabVIEW add-ons.	2023 Q3
The LabVIEW Advanced	Signal Processing Toolkit Signal Processing Toolkit is a set time series, and wavelet analysi	of software tools that you can use	2023 Q1
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LabVIEW Desktop E The LabVIEW Desktop E advanced debugging.		perform dynamic code analysis fo	2023
		pport for LabVIEW 2023 (64 t support files for LabVIEW 2023 (6	
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Installing LabVIEW and Dr	ivers		×
Select	Agree	Review	Finish

Information about the products to be installed.

NI-TSU Driver

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Firewall Information for NI-Sync

NE-Sync includes support for synchronization over Ethernet-based networks using the Precision Time Protocal (PTP) specified by IEEE 1588-2088. The NI TSU Clock Service requires access to the PTP Event port (UDP 319) and the PTP General Port (UDP 320) to send and receive multicast data. The NI TSU Clock Service automatically configures the Windows Firewall, but you must manually configure any third-party firewall products.

By continuing with this installation, you are agreeing to add NI TSU Clock Service to the Windows Firewall exceptions list.

Next

Installing LabVIEW and Drivers		× Ctivate Software	
Select Agree	Review Finish		Create a user account
Review the following summary befo	pre continuing.	Let's get started	
 Install 		You must obtain and activate a software license to continue. Learn more	
ASAM e.V. DataPlugin for AOP5	21.5.0	.0	
JKI VI Package Manager	2023 Q3	13	
LabVIEW (64-bit) English	2023 Q3 Patch 1	Log in to Activate	
LabVIEW Advanced Signal Processing Toolkit (64-bit)	2023 Q1		
LabVIEW Database Connectivity Toolkit (64-bit)	2023 Q1	1	
LabVIEW DataFinder Connectivity VIs (64-bit)	2023 Q1	1	
LabVIEW Desktop Execution Trace Toolkit	2023	13	
LabVIEW Digital Filter Design Toolkit (64-bit)	2023 Q1	<u>1</u>	
LabVIEW Project Dependency Support Software	2023 Q3	13	
LabVIEW Report Generation Toolkit (64-bit)	2023 Q1	1	
LabVIEW Runtime (32-bit)	2020 SP1 f1	1 No internet co	nnection? Activate offlin
Back	Next	Privacy Statement	Cancel
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UNIVERSITÀ DEGLI STUDI DI TRIESTE

