

INSTRUMENTATIE VIRTUALA

CURS 10





Controlul instrumentelor

Obiective

3

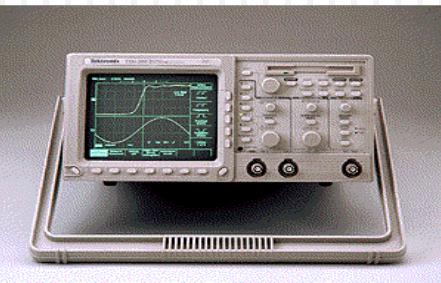
- Instrument Assistant
- Porturi de comunicare: GPIB, Serial, USB
- Arhitectura (VISA): Virtual Instrument Software Architecture
- Drivere de instrument (retea de drivere NI)
- Functiile driverelor de instrument

Introducere in controlul instrumentelor

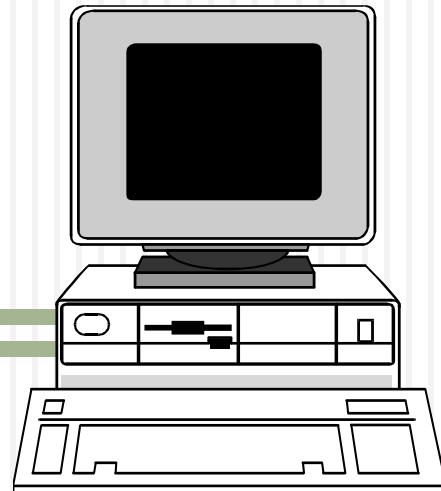
4

- Puteti controla orice instrument daca cunoasteti:
 - Tipul de conector la instrument
 - Proprietatile electrice implicate
 - Sa aveti driverul soft corespunzator
 - Tipul de cablu necesar
 - Protocolul de comunicare folosit

Instruments



Computer



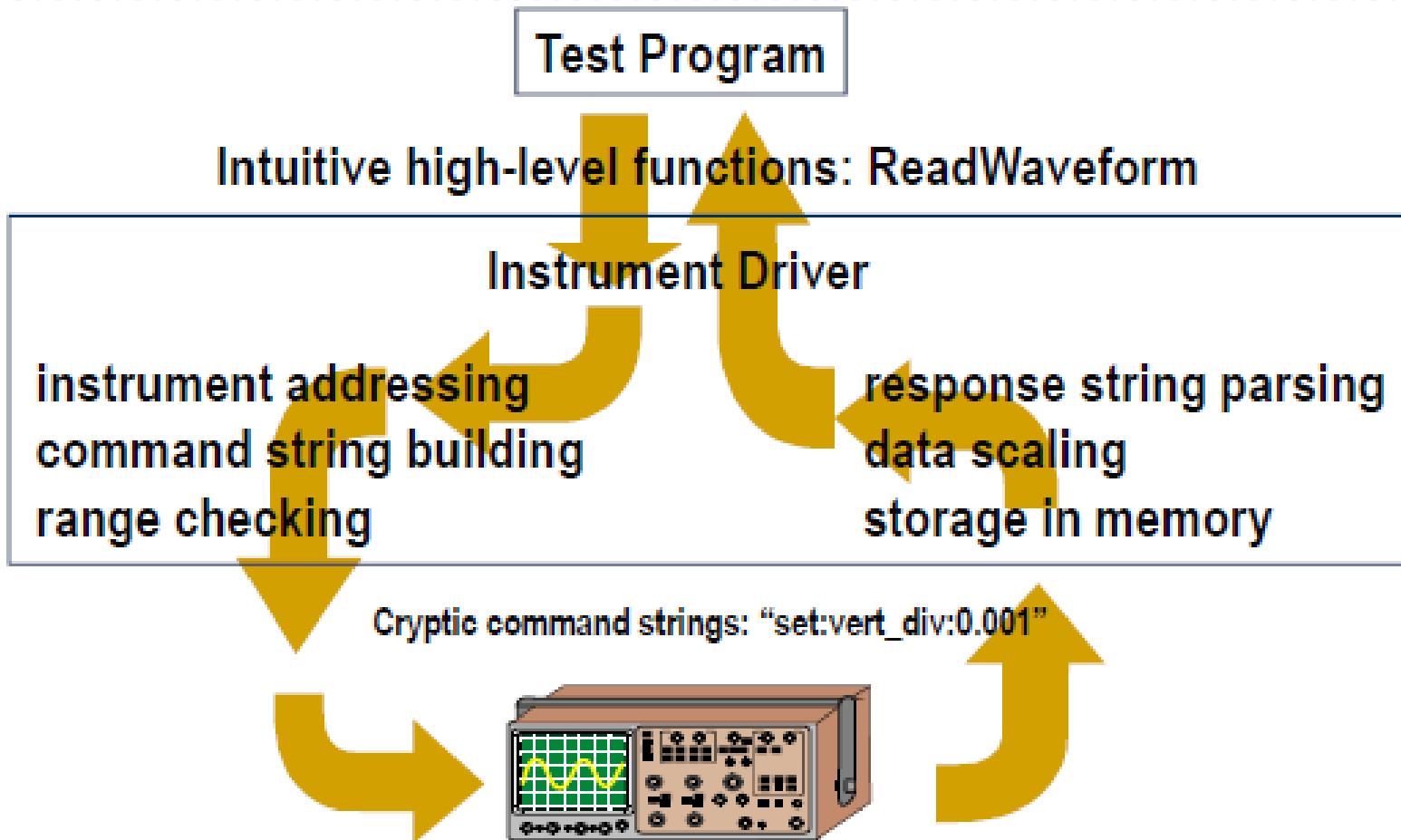
Introducere în controlul instrumentelor

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- “An **Instrument Driver**, in the context of test and measurement (T&M) application development, is a set of software routines that simplifies remote instrument control. Instrument Drivers are specified by the IVI Foundation^[1] and define an I/O abstraction layer using Virtual Instrument Software Architecture (VISA).”

Sursa https://en.wikipedia.org/wiki/Instrument_Driver

Utilizarea drivere-lor de instrument



Gasirea drivere-lor de instrument

- De la producator
 - CD, DVD, memory stick sau web site
 - Ofera doar API (DLLs)
 - Nu ofera de loc
- NI Instrument Driver Network
 - Gasirea de drivere
 - Informatii despre cum se dezvolta si se utilizeaza driverele
 - Incarcarea driverelor dezvoltate personal

NI Instrument Driver Network

- De pe site www.ni.com/idnet

The screenshot shows the homepage of the NI Instrument Driver Network (IDNet). At the top, there is a navigation bar with links for INNOVATIONS, PRODUCTS, SUPPORT, and COMMUNITY. On the right side of the header, there is a "MY ACCOUNT" section with a user icon and the text "Cotfas | Log out". Below the header, there is a search bar with the placeholder "Enter keywords" and a magnifying glass icon. To the left of the search bar, there is a dropdown menu labeled "Cautare in" with the option "Drivere pentru instrumente" selected. There is also a "Popular Drivers" section featuring "Tektronix TDS 200 1000 2000" and "Agilent E363XA Series". On the right, there is a "Submit a Driver" button and a link to "Instrument Driver Certification". The URL in the browser's address bar is "Home > Support > Downloads > Drivers > 3rd Party Instrument Drivers".

- Cautare direct din LabVIEW

The screenshot shows the LabVIEW application window. The title bar says "LabVIEW". The menu bar has "File", "Operate", "Tools", and "Help". The "Tools" menu is currently open, showing options like "Choose Environment", "Measurement & Automation Explorer...", "Instrumentation" (which is highlighted with a blue selection bar), "FPGA Module", "Real-Time Module", and "MathScript Window...". A sub-menu for "Instrumentation" is also open, listing "Find Instrument Drivers...", "Create Instrument Driver Project...", "NI I/O Trace...", "Advanced Development" (with a right-pointing arrow indicating more options), and "Visit Instrument Driver Network...". The main workspace of LabVIEW is visible in the background.

NI Instrument Driver Network

□ Selectarea producatorului

The screenshot shows the 'NI Instrument Driver Finder - Configure Search' window. On the left, there's a tree view of 'Connected Instruments' and 'Installed Instrument Drivers'. A tooltip message 'You are not instrument ni.com user' appears near the center. On the right, a dropdown menu titled '<select one>' lists various manufacturers. At the bottom, there's an 'Additional Keywords' input field and a checkbox for 'NI Certified Drivers Only'.

✓ <select one>

- A&D Company, Ltd.
- Accsense
- Accu Therm Corp
- Accutech
- Acton Research Corporation
- AD Data Systems
- Adam Equipment
- Adaptive Power Systems
- ADC Corporation
- Advance Devices
- Advantest
- Aeroflex
- Aerotech Unidex
- Agilent Technologies
- American Reliance
- Ametek
- Analog Devices

<select one>

Additional Keywords

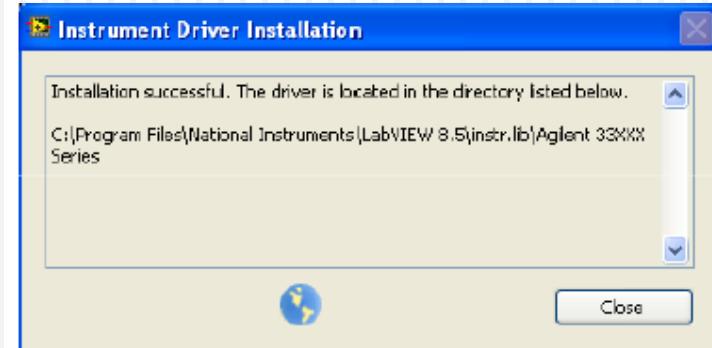
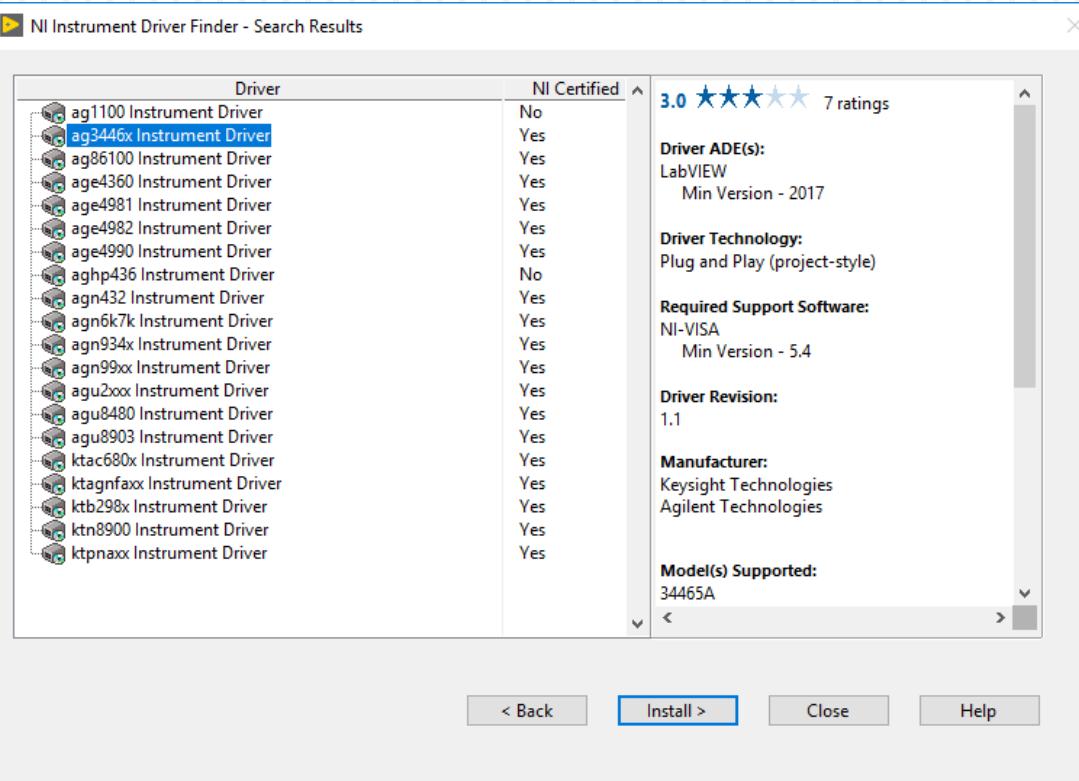
NI Certified Drivers Only

*Configure your search manually using these controls.

< Back Search > Close Help

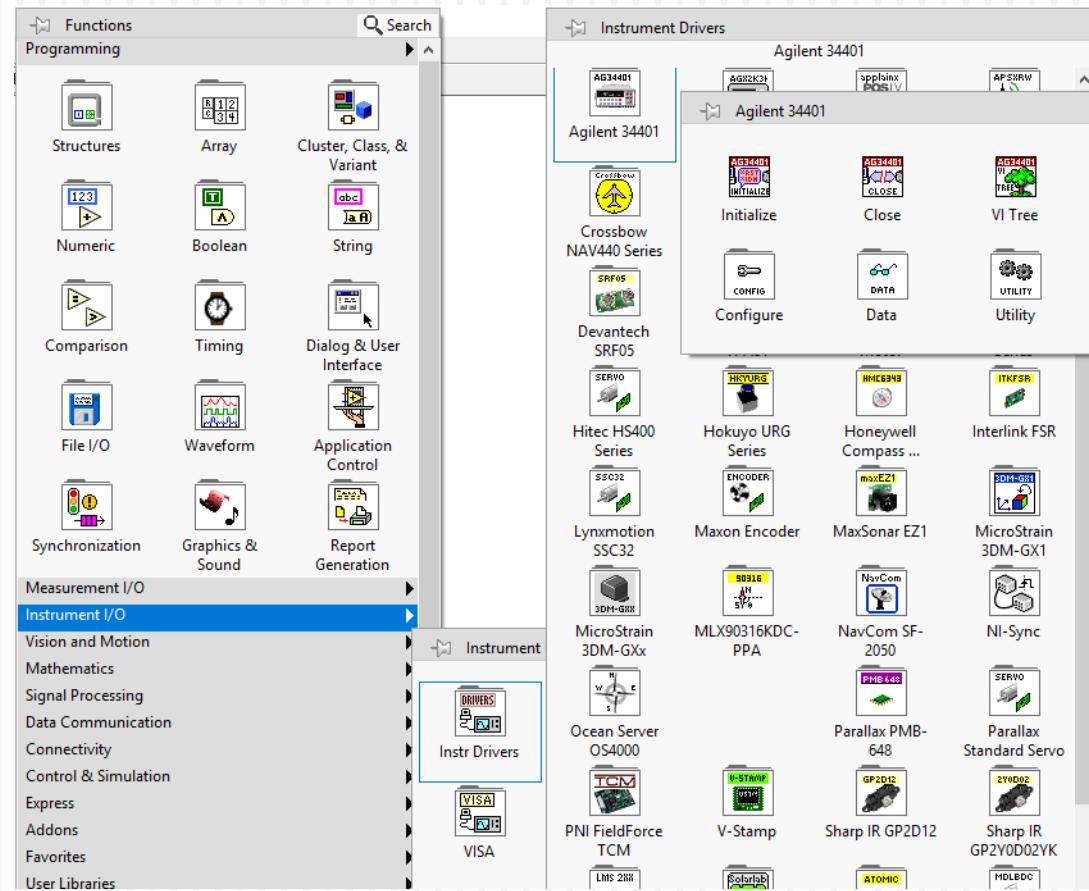
NI Instrument Driver Network

- Selectarea driver-ului de instalat
 - ▣ Instalati libraria de drivere in directorul:
 - LabVIEW xxx\instr.lib



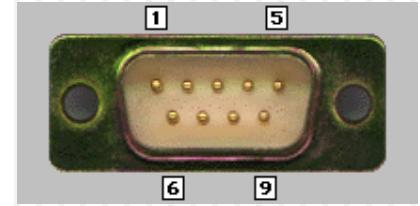
NI Instrument Driver Network

- Utilizare driver
- Accesati driverul prin subpaleta:
 - Functions>>
Instrument I/O>>
Instrument Drivers



Interfete hardware

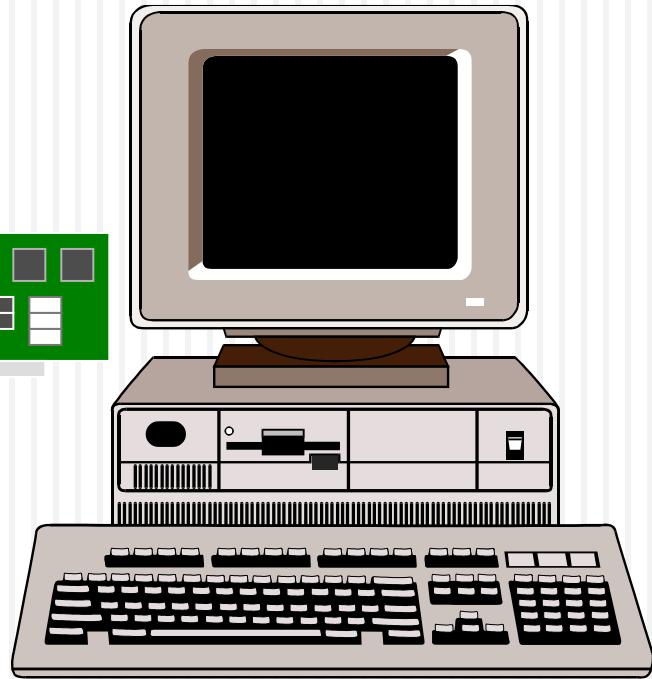
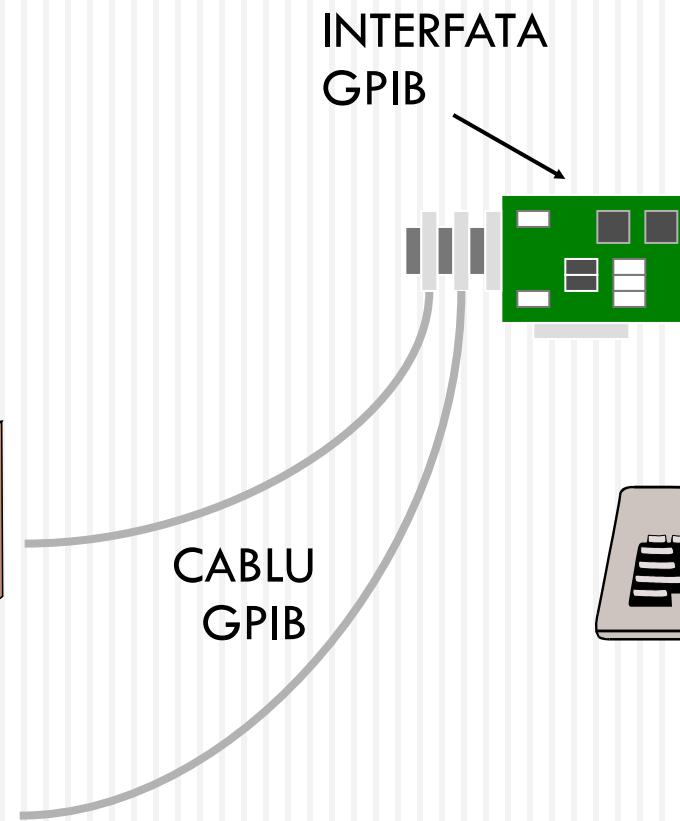
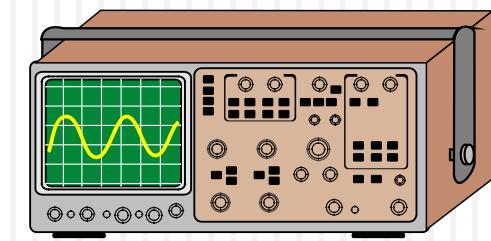
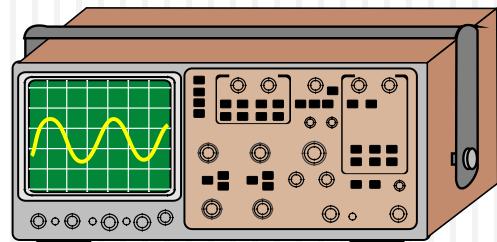
- Serial (RS232,...)
- GPIB – IEEE 488
- USB
- FireWire – IEEE 1394
- Ethernet (IEEE 802.3,...)
- Magistrale interne
 - ▣ ISA/PCI/
 - ▣ PCIe/PXIe
- Retele industriale
 - ▣ DeviceNET, PROFIBUS, ...



Comunicatia GPIB

General Purpose Interface Bus (GPIB)

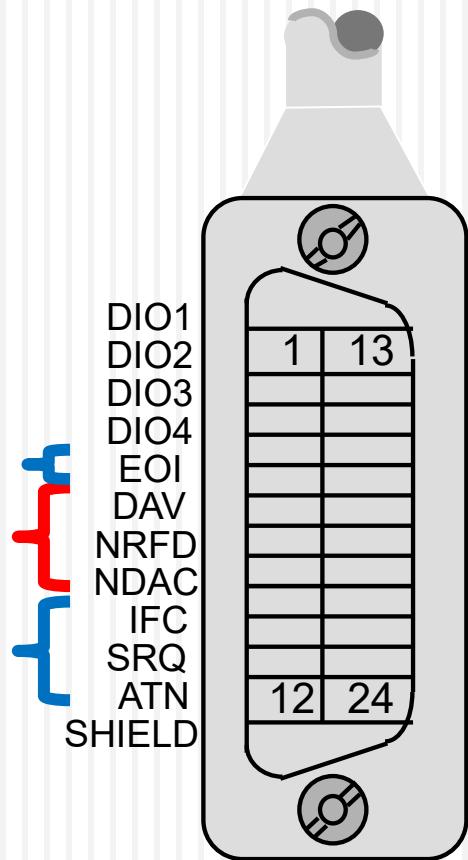
Instrumente GPIB



Standards Introduction

1965	HP designs HP-IB (Hewlett Packard Interface Bus)
1975	HP-IB becomes IEEE 488
1987	IEEE 488.2 adopted IEEE 488 becomes IEEE 488.1
1990	SCPI (Standard Commands for Programmable Instruments) added to IEEE 488.2
1992	IEEE 488.2 revised
1993	HS488 proposed
1999	HS488 approved

GPIB – Specificatii Hardware

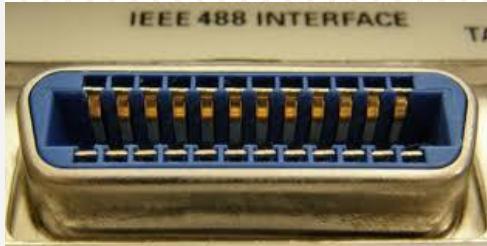


- Lungimea maxima a cablului intre dispozitive = 4 m (2 m average)
- Lungime maxima = 20 m
- Numar maxim de dispozitive = 15 (cam 2/3 alimentate)
- Interfata de comunicare digitala:
 - 8 linii de date
 - 3 linii de handshaking
 - 5 linii de control
- 1MB/s pana la 8MB/s

GPIB Hardware

- Dispozitivele si interfetele GPIB au o adresa unica intre 0 si 30:
 - In mod normal adresa 0 este atribuita interfetei GPIB
 - Instrumentele pot avea adresele intre 1 si 30
 - Dispozitivele GPIB pot fi “talkers, listeners, or controllers”.

GPIB Hardware



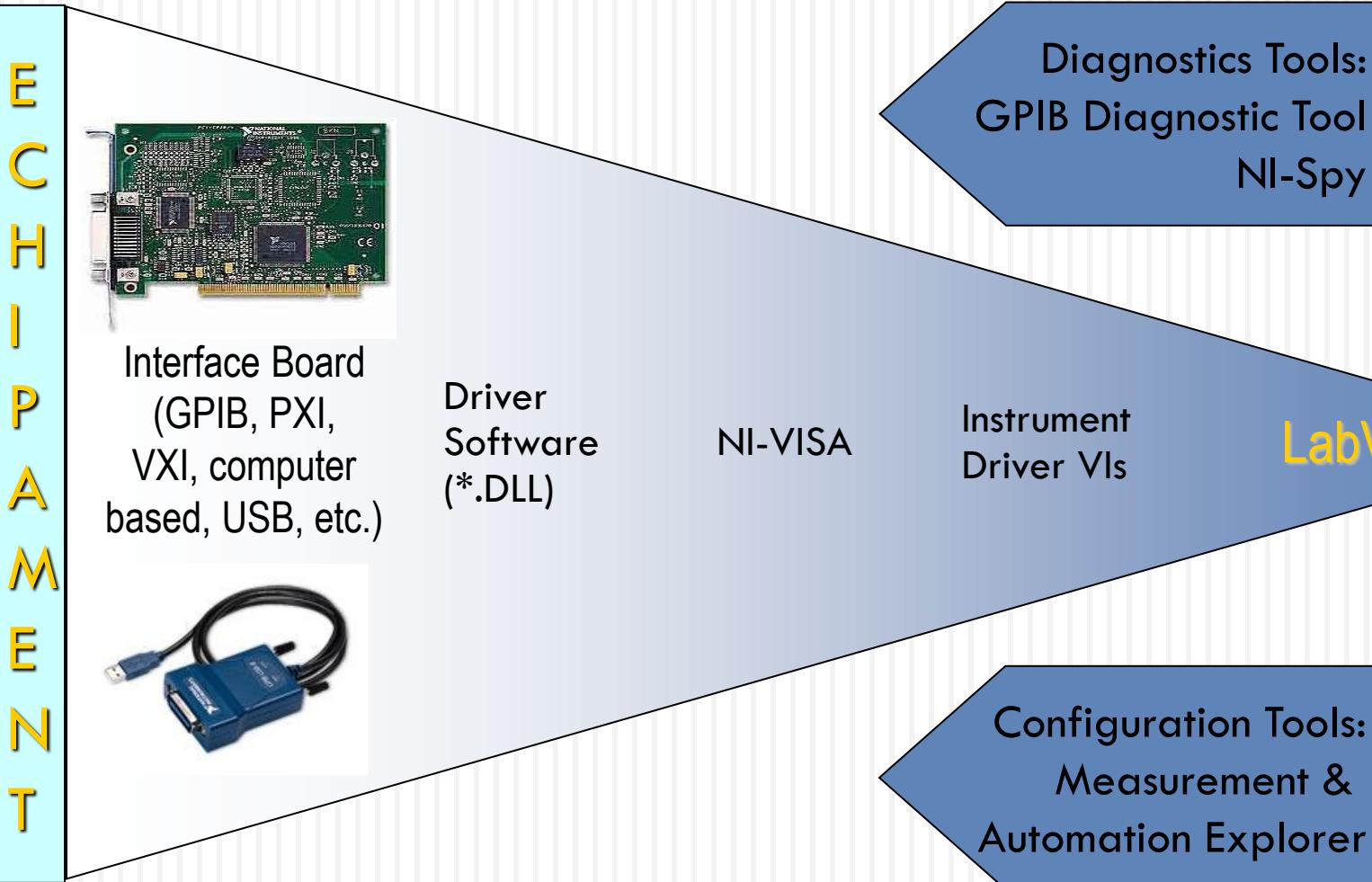
GPIB-USB

GPIB-RS232

GPIB-PCI

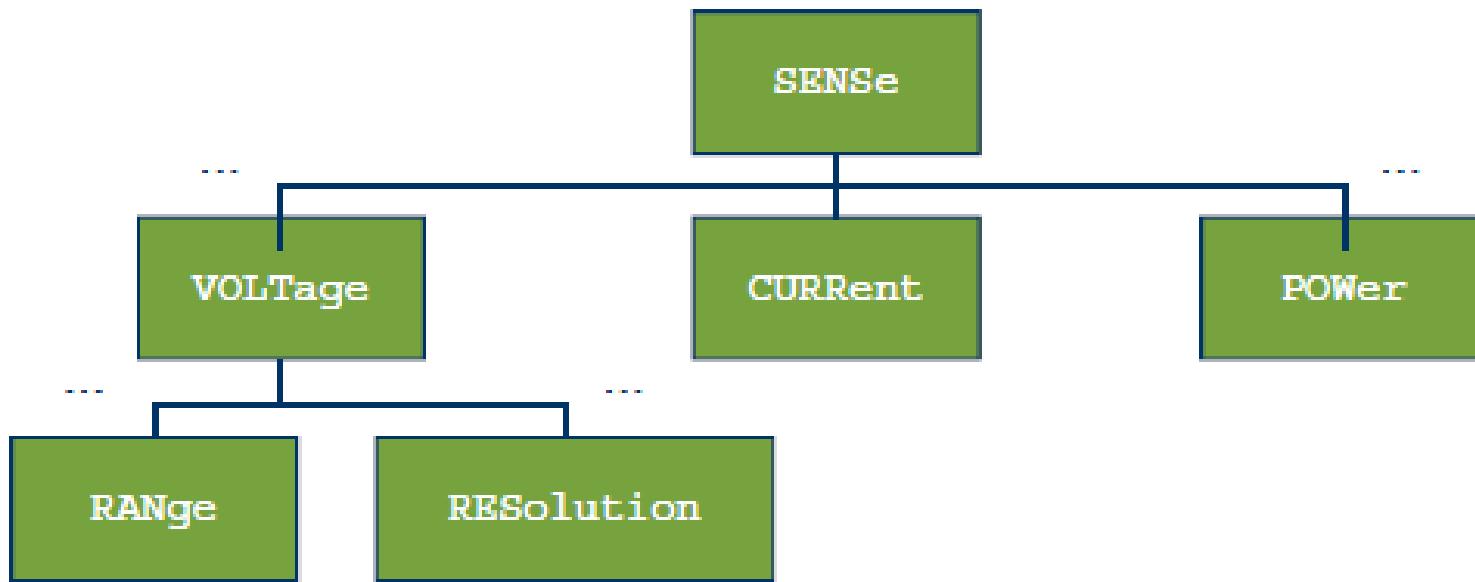
Interfete de instrument software

GPIB Arhitectura software — Windows



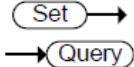
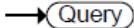
Programarea cu SCPI

- Standard Commands for Programmable Instruments
 - Comenzi standard de tipul: *IDN?, *RST, *TST?, ...
 - Structura comenzilor ierarhica:
 - Forma lungă
 - Forma scurtă



Programarea cu SCPI - Exemple

□ Configurare - interogare

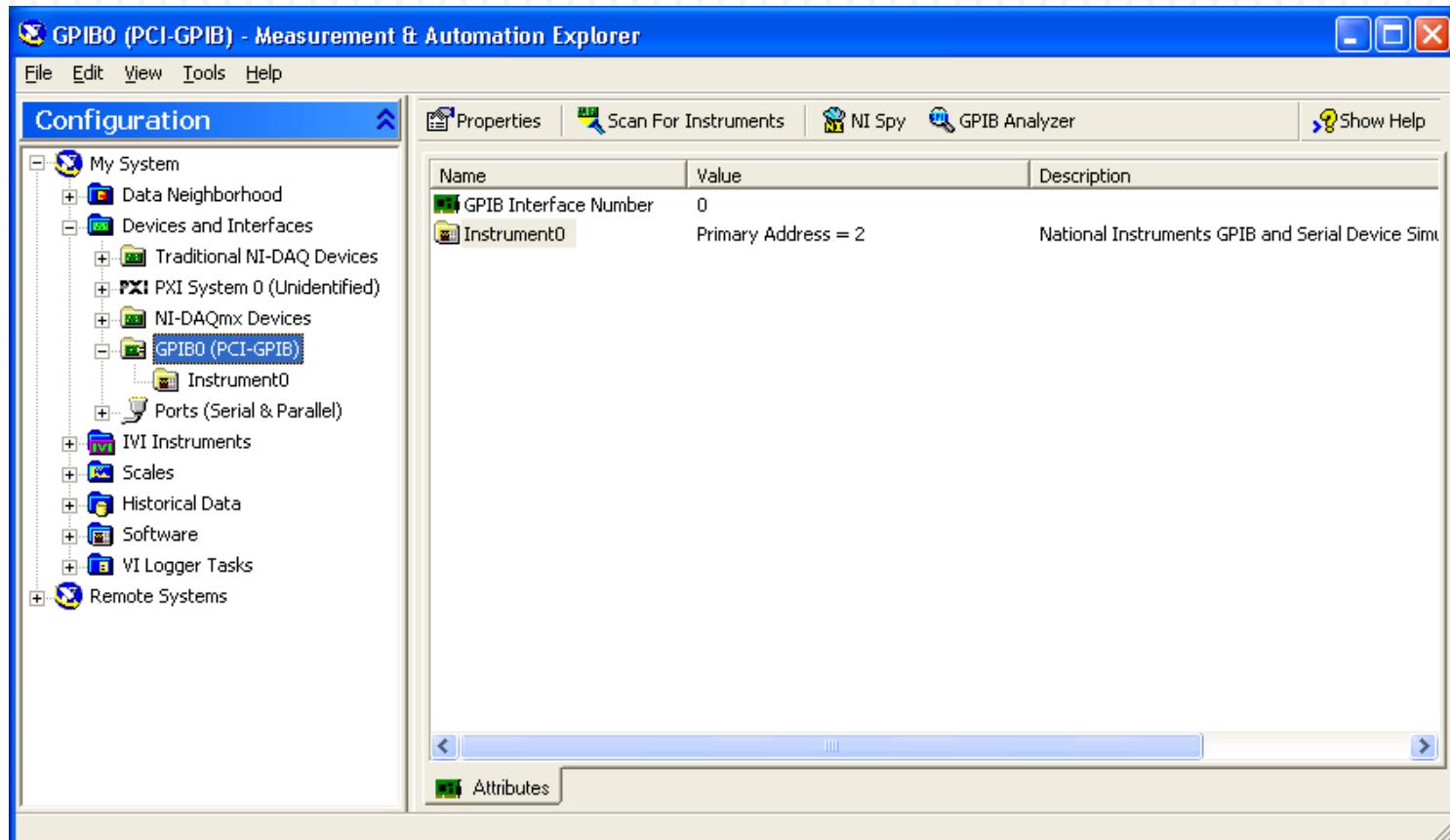
:ACQuire:MODE		 Set →	 Query												
Description		Selects or returns the acquisition mode. Same as: Acquire key → F1 ~ F3													
Syntax		< Long >	< Short >												
:acquire:mode <NR1>		:acq:mod <NR1>													
:acquire:mode?		:acq:mod?													
Parameter		<table border="1"><tr><td><NR1></td><td>Mode</td><td><NR1></td><td>Mode</td></tr><tr><td>0</td><td>Normal</td><td>2</td><td>Average</td></tr><tr><td>1</td><td>Peak detect</td><td></td><td></td></tr></table>	<NR1>	Mode	<NR1>	Mode	0	Normal	2	Average	1	Peak detect			
<NR1>	Mode	<NR1>	Mode												
0	Normal	2	Average												
1	Peak detect														
Example		:acquire:mode 2 :acquire:average 2	Selects the average acquisition mode, and select the average number 4												

□ Interogare

:MEASure:VPP		 Query
Description	Returns the peak-to-peak amplitude (difference between maximum and minimum amplitude)	
Syntax	Same as: Measure key → F1~F5 → F3 (Vpp)	
Syntax	< Long >	< Short >
	:measure:vpp?	:meas:vpp?
Returns	<NR3>	
Note	Before using this command, select the measurement channel. See the example below.	
Example	:measure:source 1 :measure:vpp?	Selects Channel 1, and then measures the peak-to-peak amplitude.

Configurarea placi GPIB si a Instrumentului

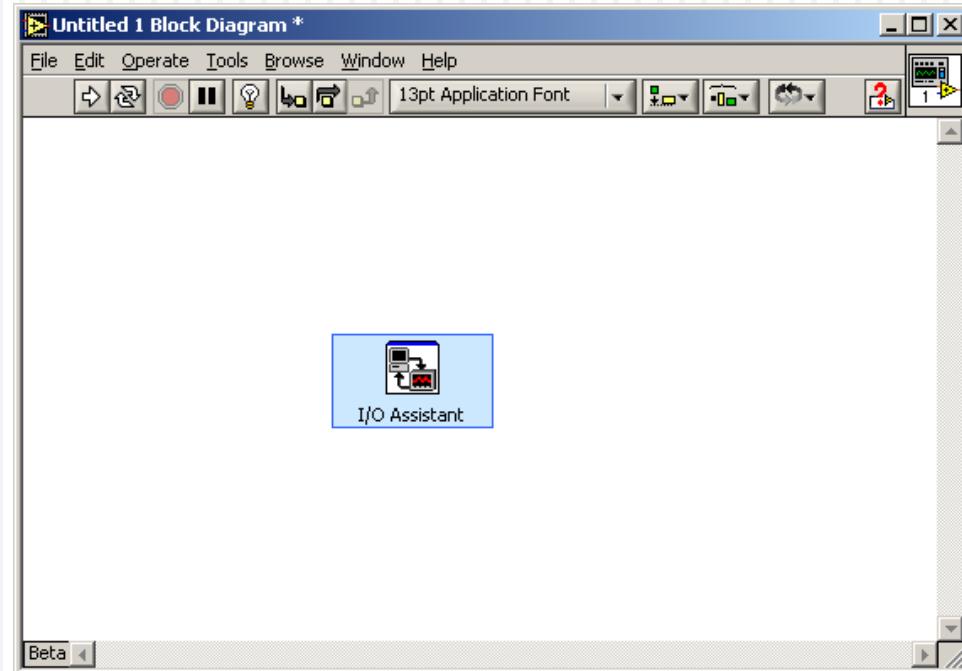
Folosim: Measurement & Automation Explorer (MAX)



GPIB in LabVIEW – functii high level

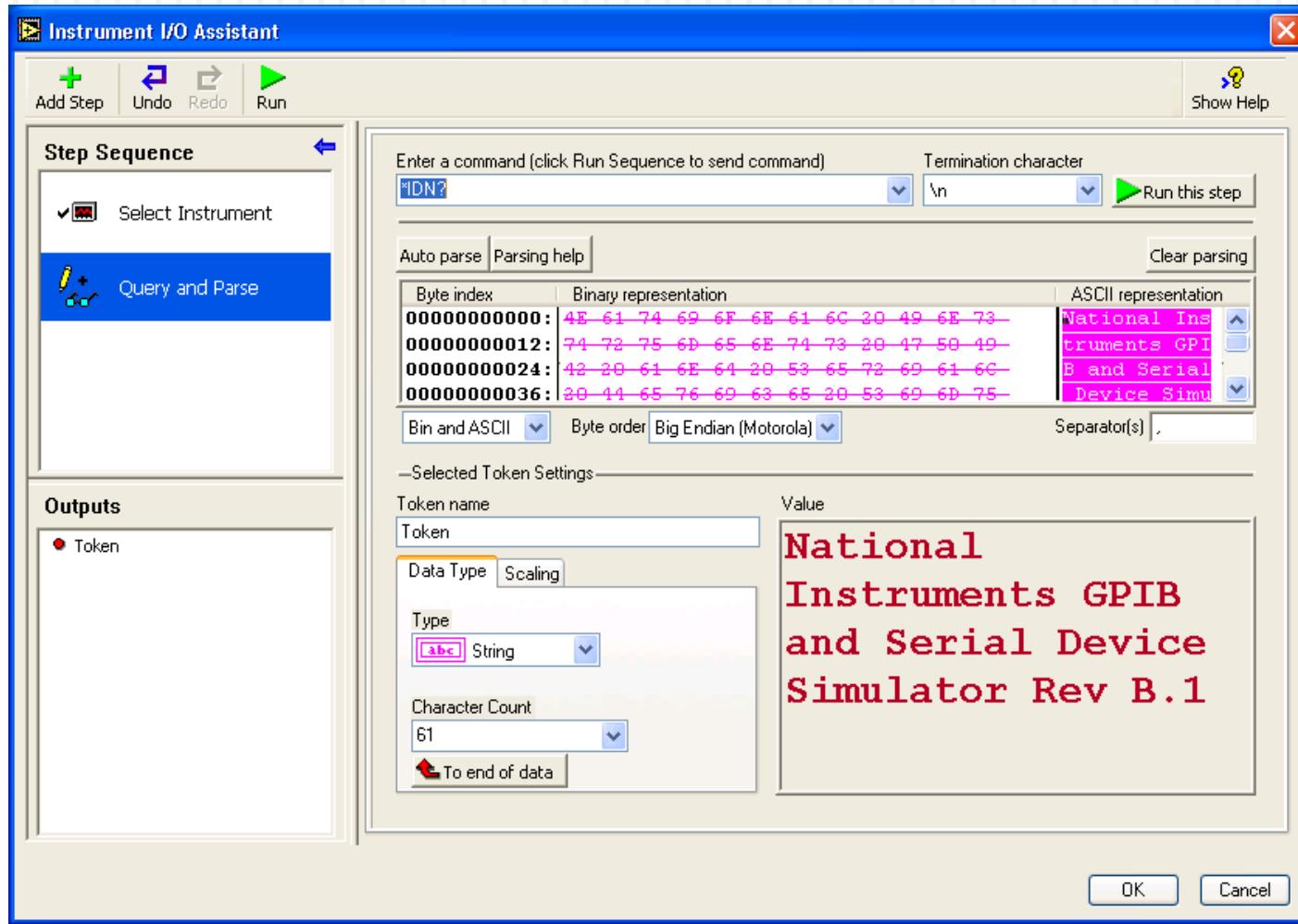
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- Instrument I/O Assistant
 - Accesibil printr-un VI Express din mediul LabVIEW
 - Setarea comunicarii cu un dispozitiv (placa DAQ) și configurarea achiziției pas cu pas – folosind o interfață de configurare



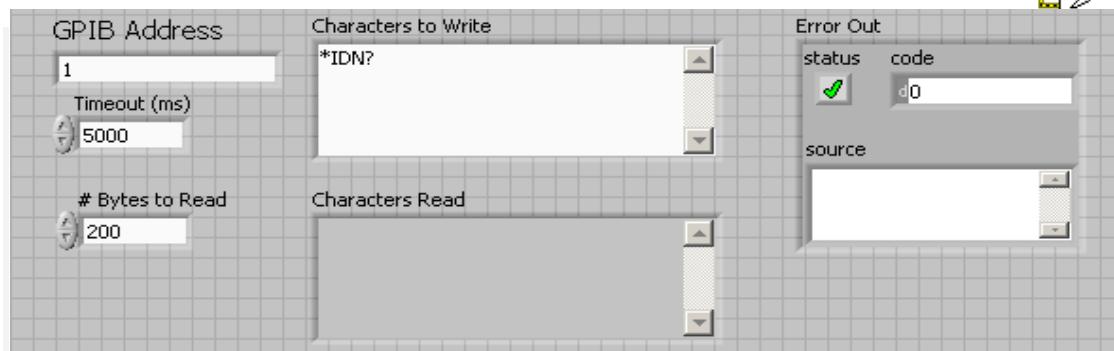
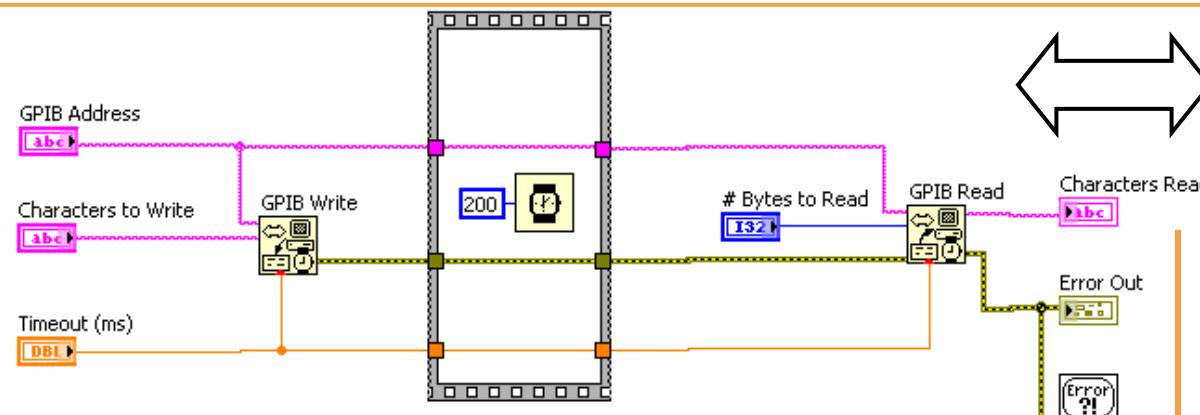
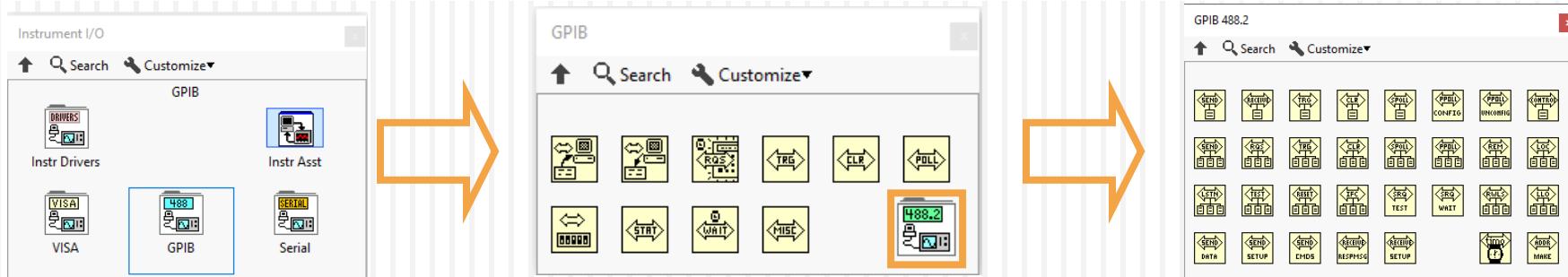
GPIB in LabVIEW – functii high level

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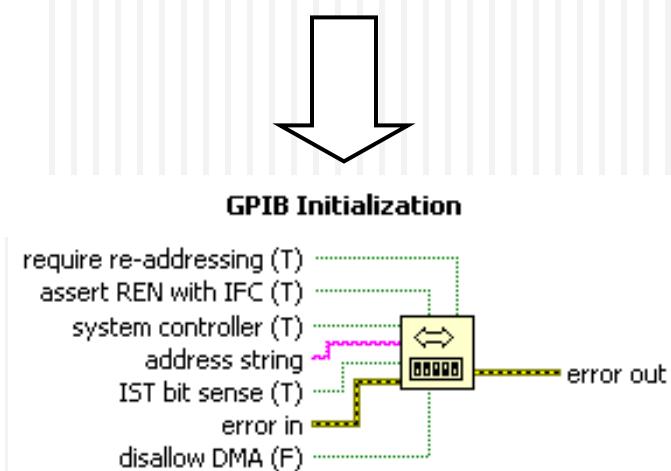


GPIB in LabVIEW – functii intermediate

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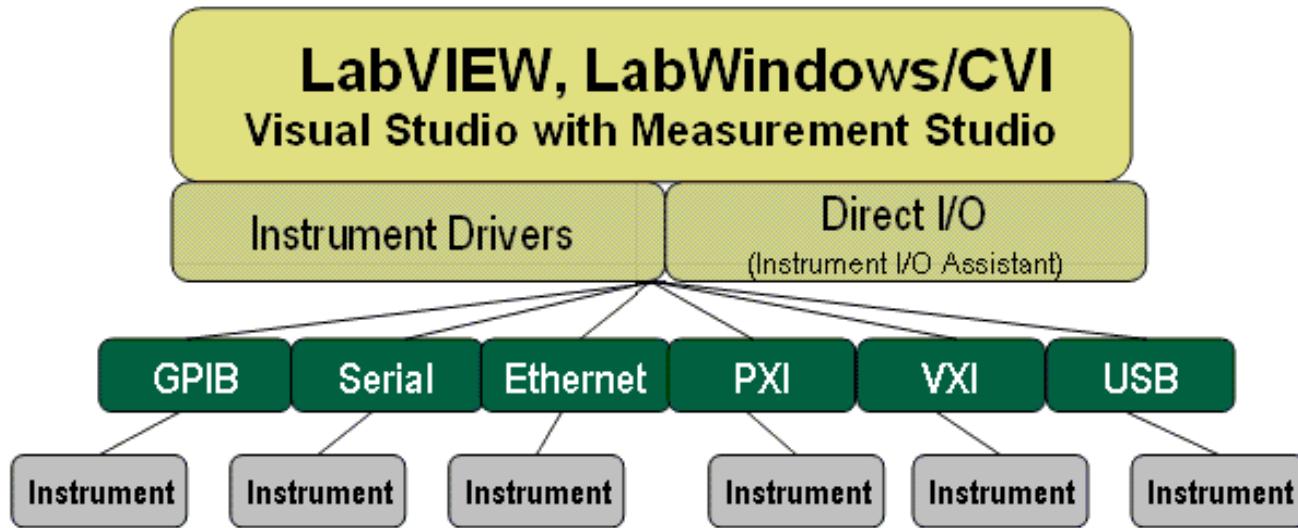


Pentru initializarea interfetei GPIB se foloseste nodul "GPIB Initialization", inainte de a folosi nodurile de R/W



Configures the GPIB interface at **address string**.

Virtual Instrument Software Architecture – VISA



- Independenta de platforma
- VISA este un backbone pentru IVI si drivere pentru instrumente Plug & Play
- Independenta de interfata
- Trebuie cunoscute comezi SCPI pentru a realiza un program direct cu VISA

Terminologia VISA

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- **Resource** - Instrument pe portul Serial sau Paralel
- **Session** - Legarea la o Resursă
- **Instrument Descriptor** - Localizarea acestei Resurse
 - Format: Interface Type::Address::INSTR
 - Examples:

GPIB0::1::INSTR
GPIB0::4::INSTR
GPIB0::10::INSTR
ASRL1::INSTR
ASRL2::INSTR
ASRL3::INSTR
ASRL10::INSTR

Instrument Descriptor Syntax

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- Resource Name contine informatii despre interfata
- Se poate lucra cu VISA Aliases

Interfata	Sintaxa Resource Name
Serial	ASRL [board] [::INSTR]
GPIB	GPIB [board] :: <i>primary address</i> [::INSTR]
VXI	VXI [board] ::VXI <i>logical address</i> [::INSTR]
GPIB-VXI	GPIB-VXI [board] ::GPIB-VXI <i>primary address</i> ::VXI <i>logical address</i> [::INSTR]

Numele Resursei VISA

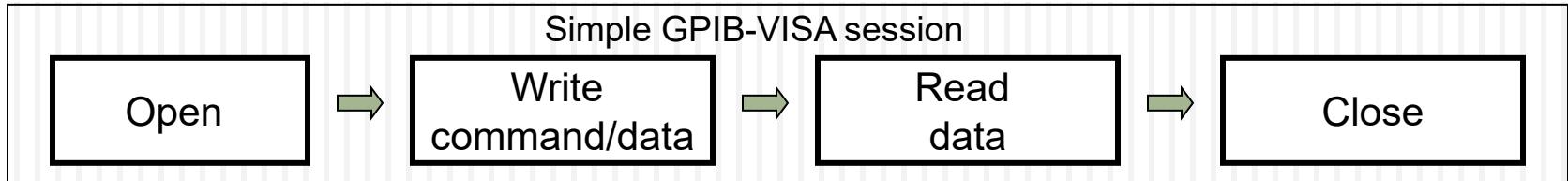
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- Numele exact si locatia instrumentului
- Foloseste “**VISA Resource Name**” pentru control
- Se poate specifica intregul nume al resursei pentru a forma un **VISA Alias**

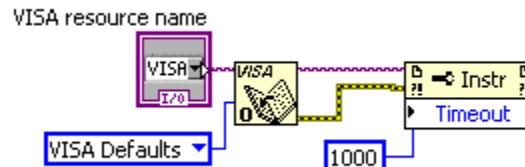
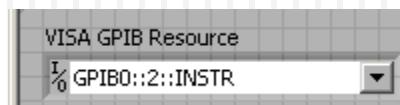


VISA in LabVIEW

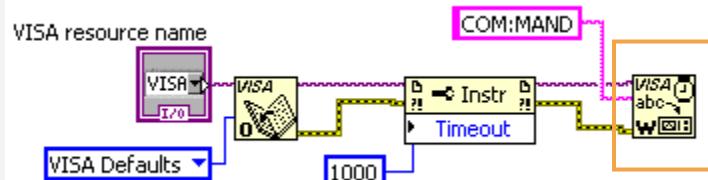
32



- Deschiderea sesiunii VISA utilizand resursa instrumentului. Configurarea timeout-lui

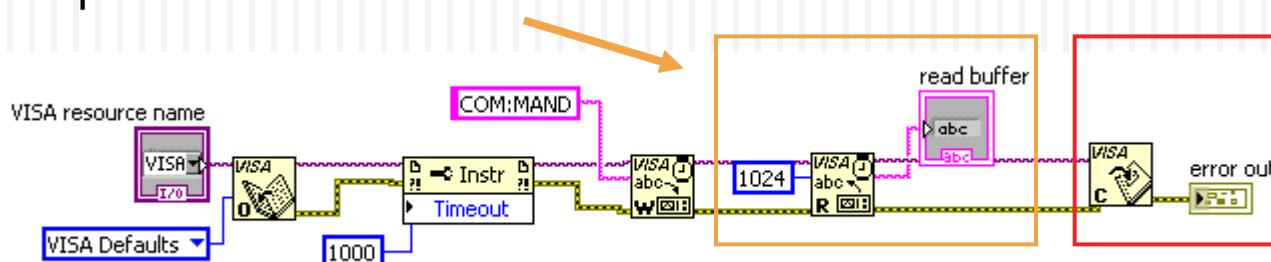


- Scrierea comenzi catre instrument cu nodul Write



- Citirea raspunsului de la instrument

- Inchiderea sesiunii VISA

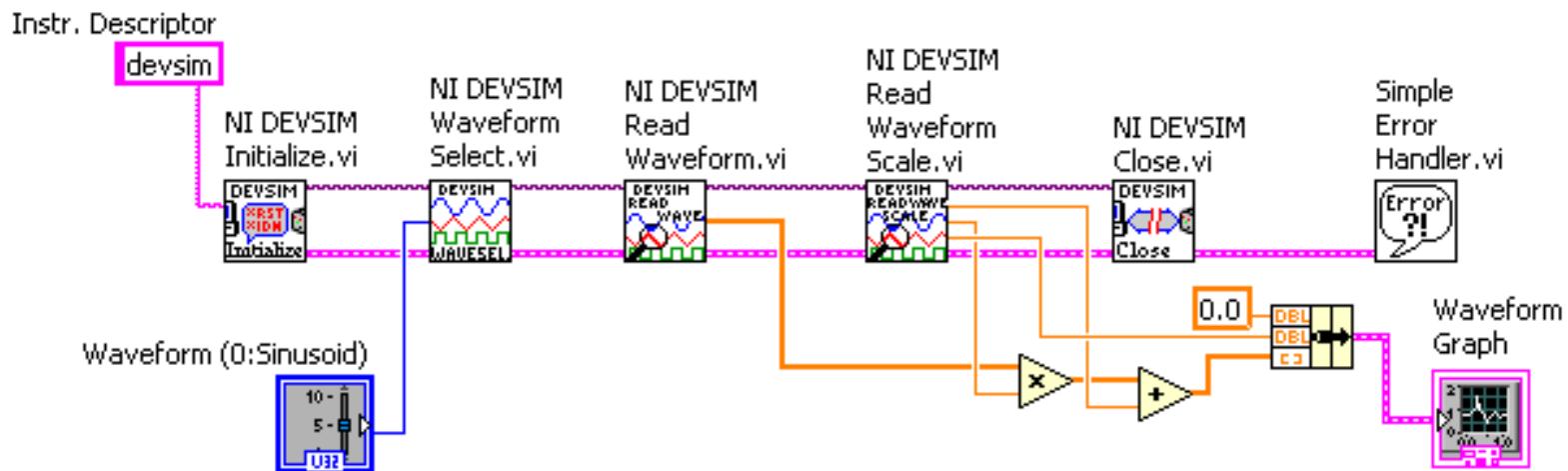


Se recomanda utilizarea functiilor VISA in detrimentul celor GPIB, datorita versatilitatii VISA

Drivere de instrument

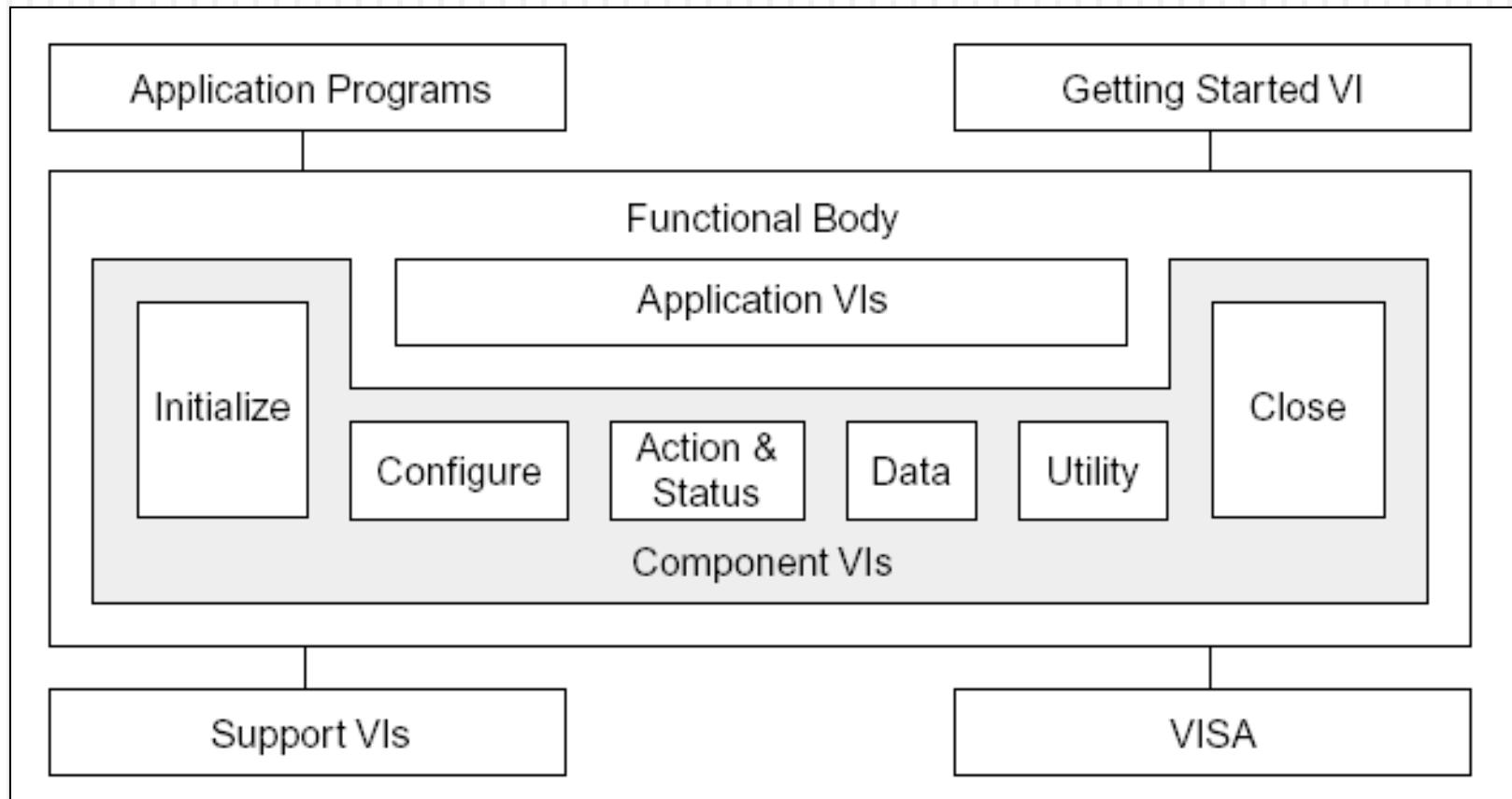
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- Există mai mult de 8000 drivere de instrumente pentru LabVIEW
- Programarea simplificată la “high-level API”



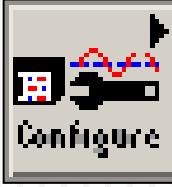
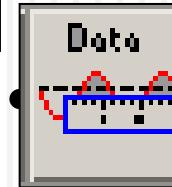
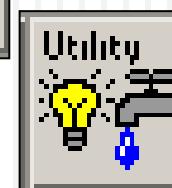
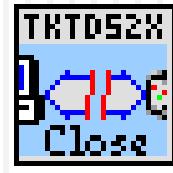
Model de driver de instrument

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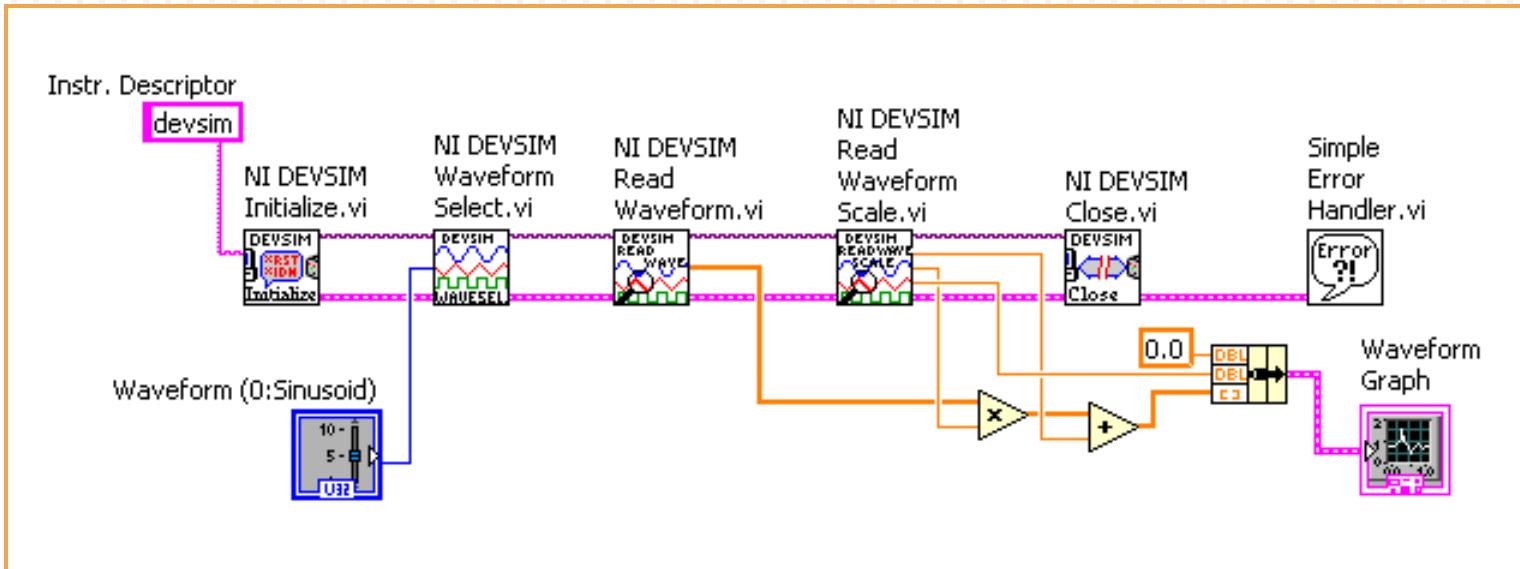
VI-uri pentru Driver de Instruments

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- **Initialize** • • • 
- **Configure** • • • • • 
- **Action/Status** • • • • • • • • 
- **Data** • 
- **Utility** • 
- **Close** • 

Toate acestea puse in aplicatie

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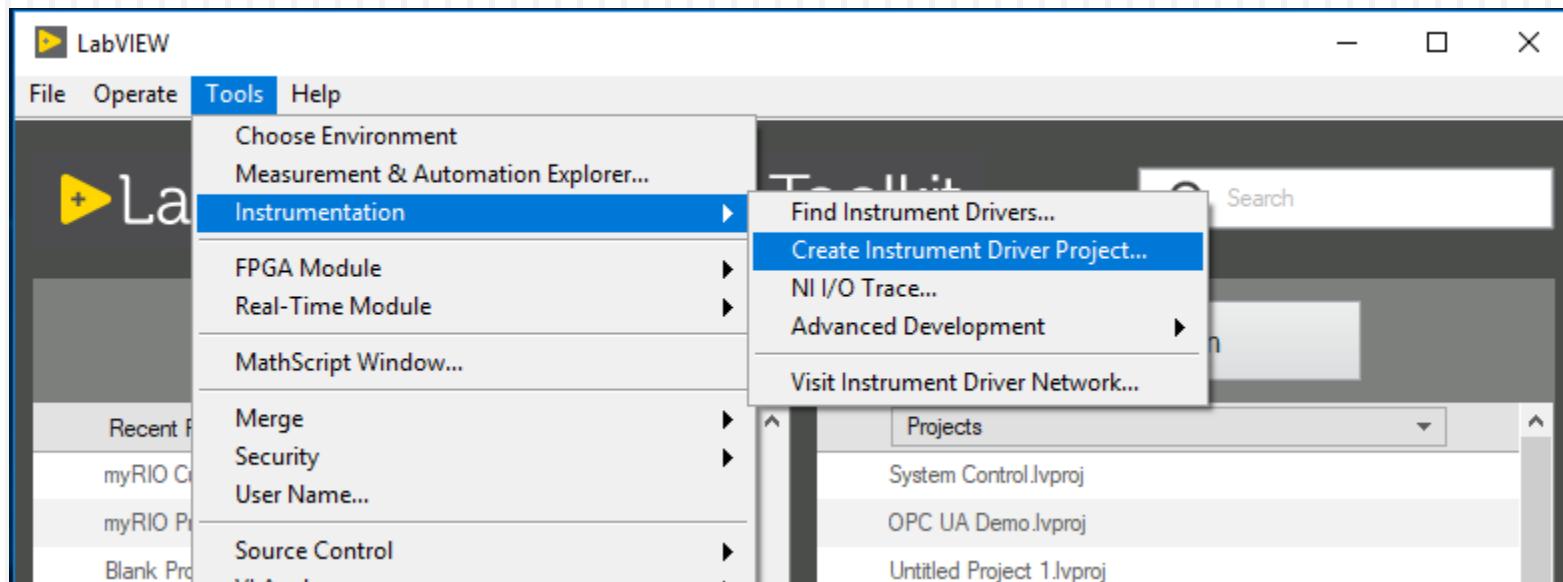


- Initializarea Instrumentului
- Realizarea operatiei (operatiilor)
- Inchiderea Instrumentului
- Verificare: daca exista erori

Ex. Instrument Driver in LabVIEW

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- Crearea unui proiect de tip Instrument Driver



Ex. Instrument Driver in LabVIEW

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Instrument Driver - Oscilloscop

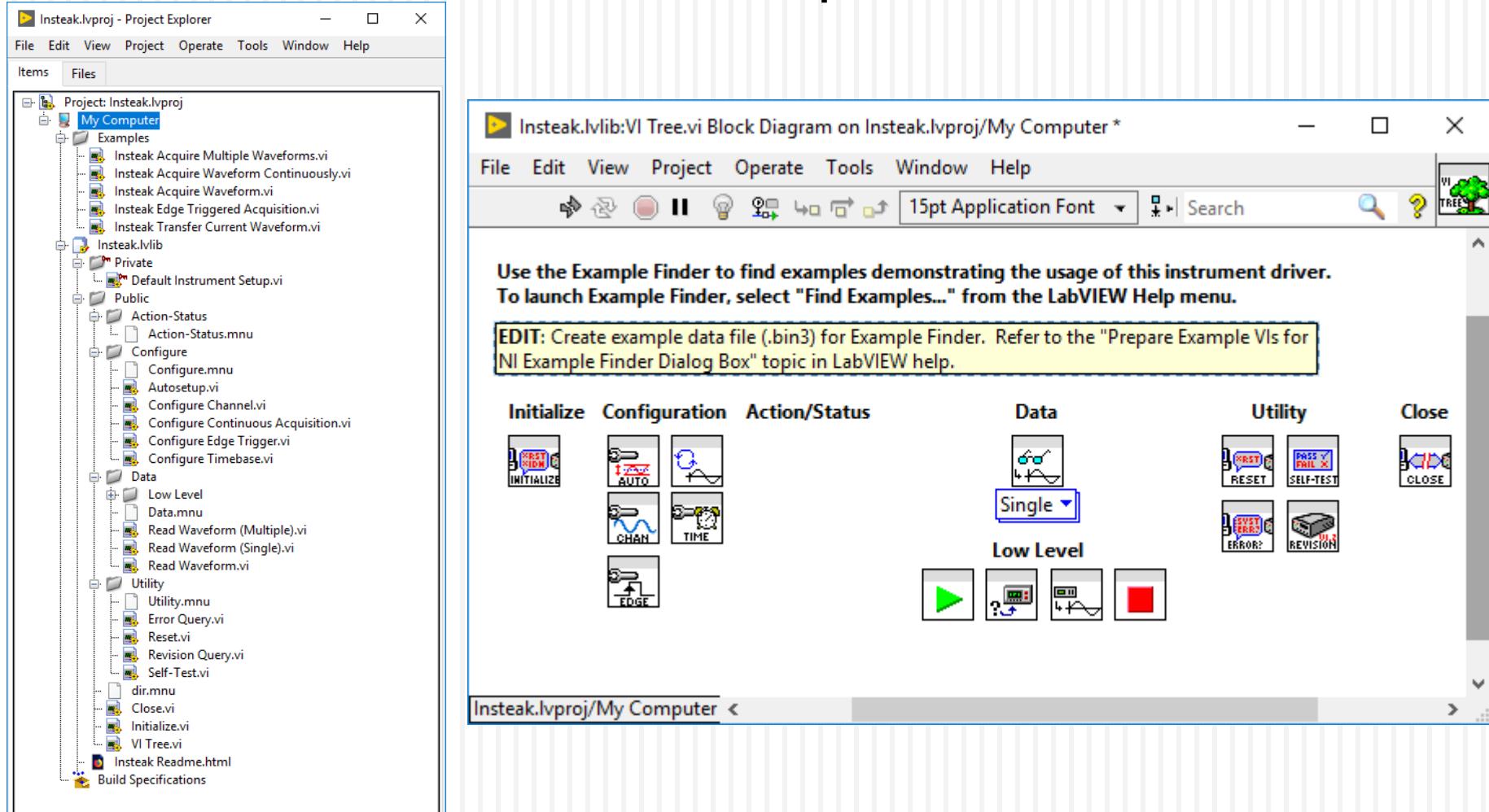
The image shows the LabVIEW Instrument Driver Network setup process through five windows:

- Create New Instrument Driver Project**:
 - Project type: New driver from template
 - Source driver: Select one
 - Select one
 - ✓ Select one
 - Counter
 - DC Power Supply
 - Digital Multimeter
 - Function Generator
 - Power Meter
 - Oscilloscope
 - Spectrum Analyzer
 - General Purpose (message-based)
 - General Purpose (register-based)
- Set New Driver Identifier and Driver Description**:
 - Driver Identifier (example: "Agilent 34401") : Insteak
 - Driver Description : LabVIEW Plug and Play instrument driver for <fill in information about manufacturer, model, and type of the instrument>.
- Creating Driver ... Please Wait**: Overall Progress bar (green) and Saving VIs progress bar (green).
- Set VI and Menu Icons**:
 - VI Icon Banner Template: B & W, 256 Color, Edit...
 - Top Palette Menu Icon: B & W, 256 Color, Edit...
- Creating Driver ... Please Wait**: Overall Progress bar (green) and Saving VIs progress bar (green).

Ex. Instrument Driver in LabVIEW

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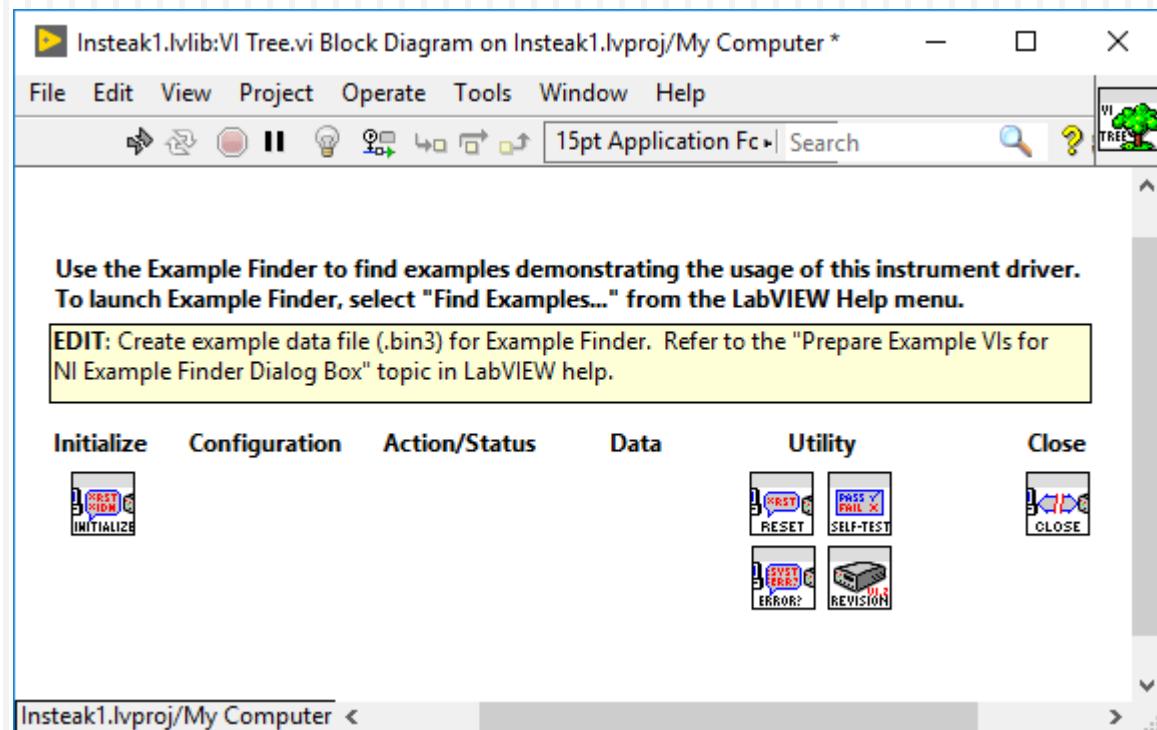
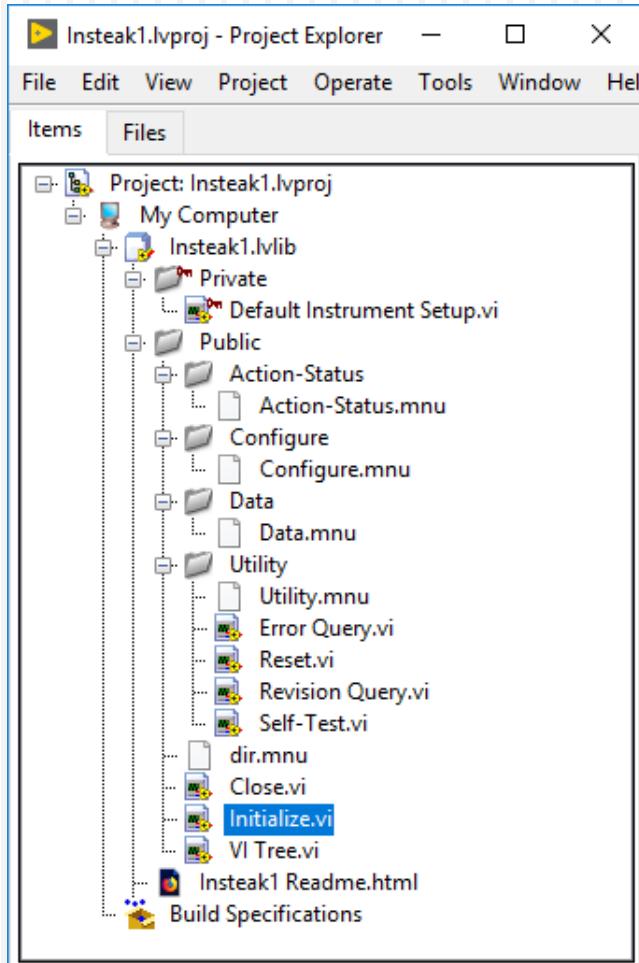
Instrument Driver - Oscilloscop



Ex. Instrument Driver in LabVIEW

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☐ Instrument Driver – General purpose (message-based)



Link-uri utile

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- <http://www.ni.com/devzone/idnet/development.htm>
- http://www.ni.com/devzone/idnet/library/instrument_driver_guidelines.htm

The screenshot shows a web browser window displaying the 'Instrument Driver Guidelines' page from the National Instruments website. The URL in the address bar is www.ni.com/devzone/idnet/library/instrument_driver_guidelines.htm. The page title is 'Instrument Driver Network' and the main section title is 'Instrument Driver Guidelines'. Below the title, it says 'August 2014 Revision'. A text block explains the purpose of the guidelines: to explain National Instruments requirements and recommendations for creating a certified LabVIEW Plug & Play instrument driver. It notes that end users look for certification as an indicator of high quality. A checklist is mentioned in conjunction with the 'Developing LabVIEW Plug and Play Instrument Drivers' application note. To the right, there are sections for 'Next Steps' (Browse All Drivers, Submit New Driver, Request New Driver, Request Support) and 'Related Links' (Development Resources, Developer Program, Developing LabVIEW Drivers, Developing LabWindows/CVI Drivers, IDDP Benefits, IDNet, How to Join, Link to your instrument drivers on IDNet, Contact, Learn How to Use Your Driver). At the bottom, there's a table titled 'Guidelines' with numbered items from 1 to 11, each with a 'View' link under 'Details'.

Guidelines	Details
1) Before You Develop Your Driver	View
2) Driver Architecture and API Design	View
3) VIs: Names and Properties	View
4) Control/Indicators: Naming and Data Representation	View
5) VI Front Panels	View
6) Icon and Connector Panes	View
7) Block Diagrams	View
8) Testing	View
9) Documentation	View
10) Example VIs	View
11) Palette Menu Files	View