# Valencia Probe Station

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ITANA



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Plan de Recuperación, Transformación y Resiliencia



# Documentation: Github wiki

## Goals

- Up-to-date
- Detailed
- Linked references
- + Step-by-step manual for probe station setup

almanzam218 /	SensorTest_CALICE_6In_256ch	Q Type 🖉 to search
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	README Rober-Cano edited this page 5 days ago - <u>44 revisions</u>	Edit New page
	Probe Station	- Pages
	The Prohe Station is an instrumentation system used to test silicon sensors, it is essentially an electronic seture with pracise	Find a page
	accessories that make it easier to use. One of its functions is to create a vacuum that polarizes the sensor.	+ Home
	Release: Still working.	Cable connection
	About this README The following list has some instructions about the drivers installation for the instrumentation used, connection procedure and implemented hardware in the probe station. There is also important information concerning the correct use and manipulation of	Hardware
		Instrumentation drivers
		Microcontroller programming
	the Probe Station. In case of error or malfunction, you can find a troubleshooting list with every problem we have faced. The PCIe-GPIB card instalation is named too to do find out that it is correctly installed.	PCle cards
	Instrumentation The LabVIEW version is the 2020 one, but not all drivers are available for that version. In that case, the optimal controller version is the latest one before 2020. The instruments set consist of:	<ul> <li>README</li> <li>Probe Station</li> <li>Release: Still working,</li> <li>About this README</li> <li>Instrumentation</li> </ul>
	KEITHLEY 6487 PICOAMMETER/VOLTAGE SOURCE (NOT USING NOW)	Cable connection
	KEITHLEY 2470 SourceMeter	Troubleshooting
	KEYSIGHT E4980AL LCR Meter 20Hz-300KHz	PCIe cards instalation
	KEITELET 0402 DUAL-CHANNEL PICUAMMETEH/VOLTAGE SOURCE	Microcontroller configuration
	Here every driver used for instrumentation.	
	Cable connection	+ Add a custom sidebar



## **Documentation**

#### Hardware

- CAD models of all mechanics and electronics
- Links to instrument drivers and manuals
- Instruments and cable specifications + connection instructions

#### Instrumentation

The LabVIEW version is the 2020 one, but not all drivers are available for that version. In that case, the optimal controller version is the latest one before 2020. The instruments set consist of:

- KEITHLEY 6487 PICOAMMETER/VOLTAGE SOURCE (NOT USING NOW)
- KEITHLEY 2470 SourceMeter
- KEYSIGHT E4980AL LCR Meter 20Hz-300KHz
- KEITHLEY 6482 DUAL-CHANNEL PICOAMMETER/VOLTAGE SOURCE

Here every driver used for instrumentation.

#### **Cable connection**

To control the LabVIEW program, it is important to link correctly every section. There are different cable in our set up:

- IEEE-488 GPIB to connect the instrumentation between them (daisy connection) and the PC (daisy connection).
- Power cable to make the instrumentation and the PC work.
- USB from type A to type B, used to connect the Probe Station to the PC and to power the Probe Station.
- BNC cable from BNC to BNC, used for the connection between the Probe Station and the instrumentation.

Here the steps to follow for a well done connection.

#### Hardware

The Probe Station is not only an electronic device, it needs a solid and sturdy structure for the optimal performance and user comfort. Various elements have been added to complete the Probe Station structure.

Here every Probe Station's structural element.

#### - README

Probe Station Release: Still working. About this README Instrumentation Cable connection Hardware Troubleshooting PCIe cards instalation Microcontroller configuration

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#### Clone this wiki locally

https://github.com/almanzam218/Se



# **Documentation**

## Software

- LabVIEW
   Troubleshooting
- Drivers

#### Troubleshooting

Error 802: Output voltage limited by interlock  $\rightarrow$  Do not enable the LabVIEW program's interlock while the instrumentation's interlock is enabled too (check it)

Error 1135: Parameter 1, Syntax error, expected name parameter 

This could happen if you modify the value of the interlock in the LabVIEW program, to solve it you have to select "No value".

Error 1: Disconnect the probe Station power cable (USB) and connect again in the same place. If the error continues and you are doing the IV curve, try changing to IV curve, run it, and then change to CV curve again.

Warning 5074: Output voltage limited by interlock → Disable interlock in the LabVIEW program's main menu.

Warning 5079: Consider using the rear triaxial connectors for better low-current measurements.

This is not an error number, but notice if you are correctly using the front or rear connectors and if it is the same as the program has selected.

#### PCIe cards instalation

- The 82351B is the selected one to allow the PC to communicate with the measurement and test instruments that use GPIB. The instruments used have a GPIB port, so the 82351B card is needed to enable the PC to communicate with them. Specifically, this card converts the computer's PCI Express bus into a GPIB controller.
- There is also an other PCIe card installation needed to make a connection with a local network, with this we can be able to
  open a remote-window from other computer outside the room so we can control it from outside. For example with the
  command xfreerdp from linux (with this command, we open a x-widnows and control the Windows PC). The Gigabit
  TG-3468 is the one selected.

Here are the instructions for a correct instalation.

#### **Microcontroller configuration**

The IC75 is a Low-power, high-performance 8/16-bit AVR® microcontroller, in order for the Probe Station to work, it needs to be programmed.

Here are the steps to follow to do a correct programming.



# Work done and progress

- We reprogrammed the microcontroller in switch matrix -> Test voltages correct!
- 2. Tested Switch Matrix "manually" with integrated buttons and display->Worked!
- 3. Tested controlling switch matrix and instruments with LabVIEW also our implementation of new instrument models->Worked!
- 4. Started test with "baby" sensor





# Baby sensor tests

- 3D Printed stencil to place baby sensor in the microscope's sight and isolate unused pins
- Tested IV and CV from 1V to 500V with probe station covered from light only
- Measurements of 9 isolated pins for reference





257 258 259 260 261 262 263 264 Values for U = 500.0 V

7 8 9 10 11

5



# Results IV: covered from light



#Current/#[nA] vs. #Voltage/#[V]



#Voltage/#[V]









# Results IV: left 2h at 100V, covered from light

185

#### #Current/#[nA] vs. #Voltage/#[V]



168

184

4.00E-01

3.00E-01

2.00E-01

1.00E-01

0.00E+00

0

#Current/#[nA] vs. #Voltage/#[V]

100



200

#Voltage/#[V]

300

400

153

#Current/#[nA] vs. #Voltage/#[V]







# Set up inside Faraday cage



Documentation: Github



# Results IV: Quick run inside Faraday cage

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## 









# Results CV: covered from light

#### 





## 

#Current/#[nA] vs. #Voltage/#[V]











# Results CV: left 2h at 100V, covered from light



# #Current/#[nA] vs. #Voltage/#[V]











# Results CV: Quick run inside Faraday cage

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## System capacitance

- Tests with pins in the air
- Only for the pins we are using for a quick test
- Low voltage to get LabVIEW running for CV setting





# CV-System capacitance Results CV: Quick run inside Faraday cage

#### Cap-SystemCap/#[pF] vs. #Voltage/#[V]



# Cap-SystemCap/#[pF] vs. #Voltage/#[V]



168









# Temperature when running

## Outside cage ~5 hours



## Inside cage ~1 hour





## Next steps

- Take measurements of other baby sensors (not scratched)
- Tests inside cage with and without cleaning residual charges
- Implement optional residual charge cleanse in LabVIEW program
- Implement more user options to LabVIEW program
- Temperature tests
- Test real sensor once we define all settings for LabVIEW