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For the upgraded ALMA Observatory

- TECHNOLOGY DEVELOPMENT -

NI-DC Power Source DC Voltage 2 LNA

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1 Change Record

Version	Date	Affected sections	Reason
Issue A	14/01/2016	all	

2 Distribution List

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3 Applicable and reference Documents

REF1.	iALMA-TEC-ICD-IAB-001-G	B2+3 Warm Test Baseplate ICD	2015-10-28
REF2.	iALMA-TEC-TRP-IAB-001-A	INAF/JPL LNAs: VNA WARM TEST. As Run Procedure and Results	2016-01-14

4 Acronyms

LNA	Low Noise Amplifier
NI	National Instruments

5 Table of content

1 Change Record 2
2 Distribution List 3
3 Applicable and reference Documents 4
4 Acronyms 4
5 Table of content 5
6 Introduction 6
7 General framework 7
7.1 Front-panel 7
7.1.1 Controls 8
7.1.2 Indicators 9
7.2 Block-Diagram 9
8 How to use the front panel 11

6 Introduction

This document describes the software designed to control the three voltage stages of the two Low Noise Amplifiers provided by INAF (back-up option) to test the fore-optics at ambient temperature.

7 General framework

The baseline LNAs will be developed by University of Manchester [REF1]. Since this baseline, named UNI-MAN LNA, is not yet available, INAF provided a back-up option (INAF LNA). This back-up option consists of two spare low noise amplifiers (S220 and S217) with gain comprised between 20 dB and 25 dB, depending on the LNA and on the frequency (REF2) . As described in [REF1], the two LNAs have 4 stages based on InP p-HEMT technology with 100 nm gate length.

The amplifiers have no voltage regulation, but do have internal transient protection in the form of resistive dividers on the gates and 1.8V diode clamps on the gates and drains. The diode clamps themselves will fail at > 2V DC so care must be taken to ensure the bias supply is transient free.

A dedicated software, based on NI I/O vi Labview modules, has been designed by INAF to properly operate and control the power supply. It allows to separately control the three voltage stages, measuring the currents (one drain current and two gate currents for each LNA unit).

7.1 Front-panel

The front panel of the module developed to control/operate the two low noise amplifiers is divided in two parts/columns, one for each LNA.

In the left part/column, the controls and indicators corresponding to the LNA #1 are reported.

In the right part/column, the controls and indicators corresponding to the LNA #2 are reported.

For each LNA, the user can operate the three stages, separately: Vd (channel 0), Vg1 (channel 1), and Vg2 (channel 2), rotating the corresponding knobs or writing the values in corresponding digital display.

The power is supplied by clicking the “output enabled” round leds.

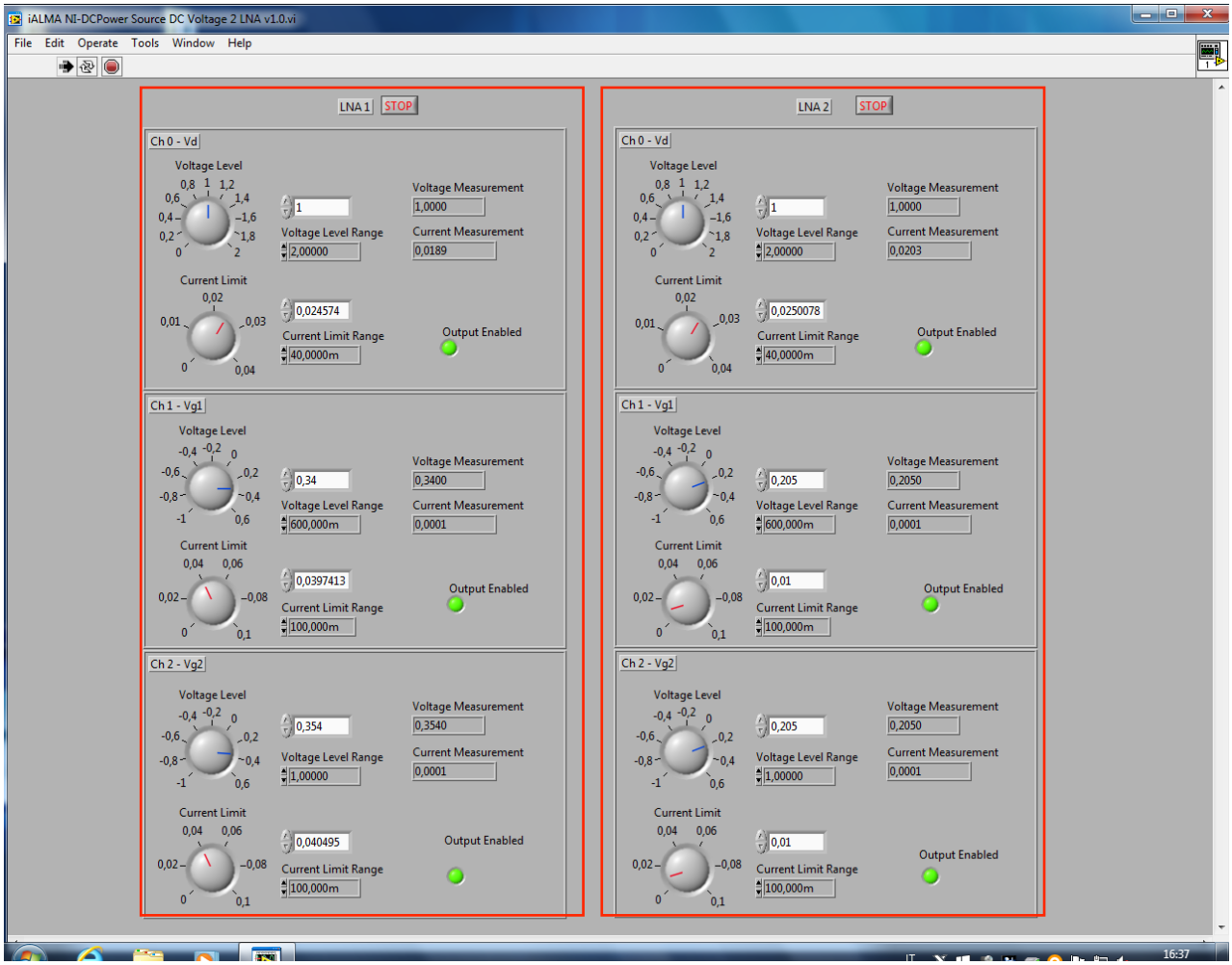

Figure 1 Front Panel of the software developed to control/operate the 2 LNAs.

7.1.1 Controls

For both LNAs, the voltage stages can be separately controlled using the following controls:

- Voltage Level (V)
- Voltage Level Range (V)
- Current Limit (A)
- Current Limit Range (A)

So, 12 controls are located in the front panel, for each LNAs.

The maximum levels of these controls have been coerced at the following values in order to preserve the LNAs integrity:

- Vd min = 0 V, Vd max = 2 V
- Id max = 40 mA
- Vg1 min = -1 V, Vg1 max = 0.6 V
- Vg2 min = -1 V, Vg2 max = 0.6 V

These values can be modified from the front panel of the VI, right clicking the control and selecting the knob property "Data Entry".

The power supply can be enabled through the on/off control named "Output enabled".

7.1.2 Indicators

Two digital displays are reported, for each voltage stage:

- Voltage measurements (V)
- Current measurements (A)

7.2 Block-Diagram

In Fig. 2 it is reported the block diagram that controls the front panel of the first LNA (PXI1Slot3). The block diagram corresponding to the second LNA is identical, but connected to the fourth slot (PXI1Slot4).

The code outside the "while loop" inizialises the controls "Voltage Level Range" and "Current Limit Range" for the three channels, separately. Furthermore, it defines that the output of the power supply is "DC voltage".

Inside the "while loop", the configuration of the "Voltage Level" and "Current Limit" is placed in the first frame of the "frame sequence" (see the upper panel of Figure 2, where the first frame is shown). In the second frame, the two indicators are located (see the bottom panel of Figure 2, where the second frame is shown). The two frames are repeated for each channel, so the frame sequence has six frames in total.

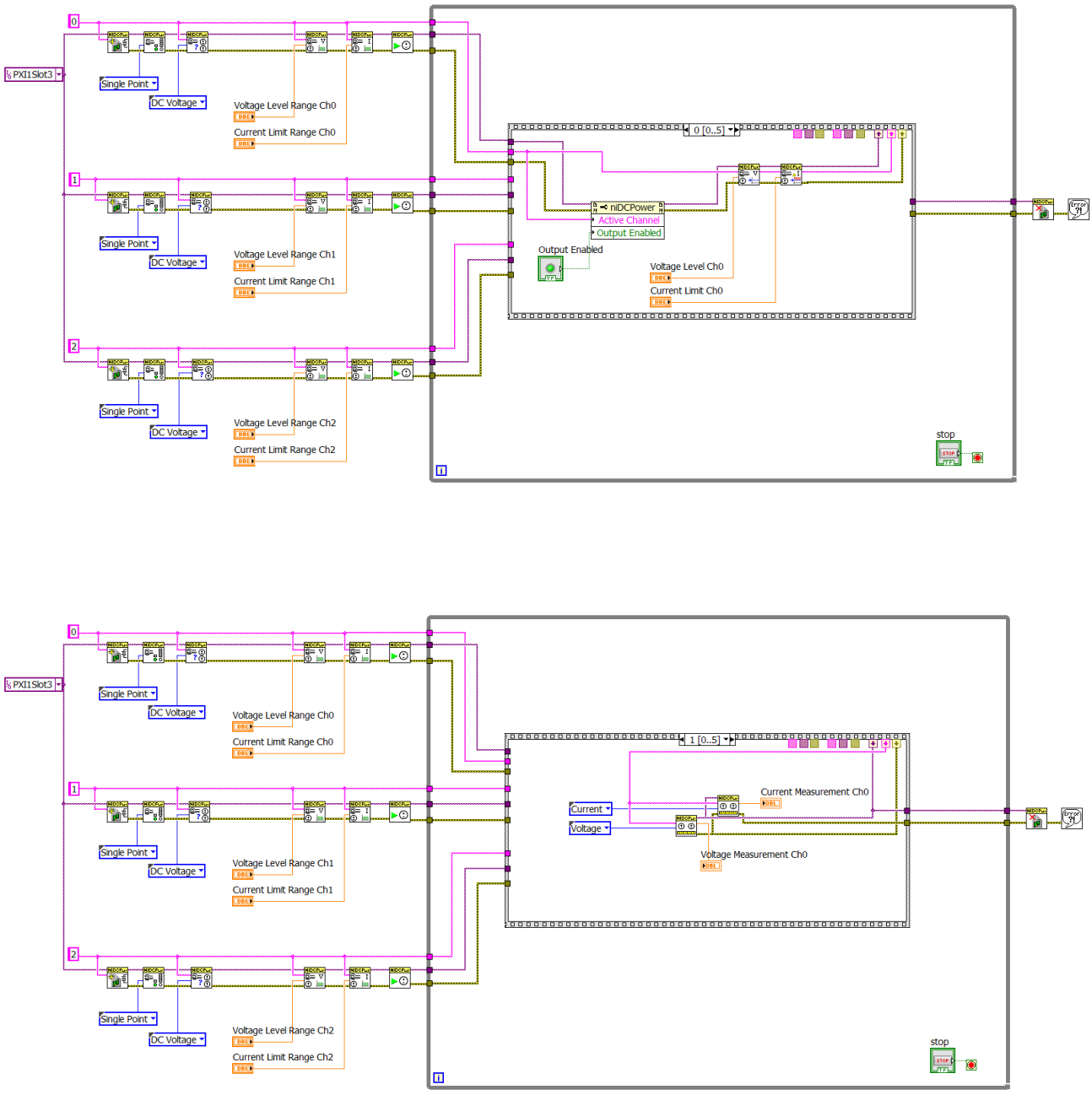

Figure 2 Block diagram to control the first LNA (PXI1Slot3).

8 How to use the front panel

To power each LNA:

1. Click the RUN botton
2. Insert Vd, Vg1, and Vg2 rotating the knob or writing the values in the corresponding digital display.
3. Insert the values of "Voltage Level Range" and "Current Limit Range" for the three stages.
4. Enable the power supply for each channel (Vd, Vg1, Vg2) from the "output enable" round led.
5. Look at the output voltages and currents shown in the indicators.

To power off each LNA:

6. Disable the power supply for each channel from the "output enable" round green led.
7. Stop the execution using the STOP botton.

Warning: if the program is stopped without disabling the power supply (from the round green led – point 6 of the above procedure), the LNAs will continue to be powered and the system should be reset manually.