Research update :
Pulsed control option board
for LSNA embedded PC

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WHY an embedded processor for the LSNA ?

Digital IO lines of 2 dedicated VXI boards are used to control the settings of :

Downconverters, FracN, Step attenuators, Test-set

The VXI boards are expensive, and a large amount of programming code is required in order to have a convenient access to the hardware settings.

Thus, we have developed a PCB with an embedded PC processor : now the LSNA is GPIB and RS232c controlled.

Our solution is included in the Maury / NMDG product

SCPI Vocabulary of LSNA, release 3.02, 1/5

*IDN	?	return "Large Signal Network Analyser"
*STB	?	return status byte of last *RST or : xxx:INIT Signification and weight of bits : b0:1 : error when initializing Digital IO lines b1:2 : error when initializing FracN b2:4 : error when initializing Downconverters b3:8 : error when initializing Test-set b4:16 : error when initializing Step attenuators b5:32 : GPIB error b6:64 : RS232c error b7:128: LSNA.ini file error
*TST	?	perform a *RST command and return the status byte
*WAI		do nothing, no response, implemented for SCPI compliance
*RST		re-initialize all the system to a defined state, idem as power-up. No response. Equivalent to perform :SYST:INIT, :FRAC:INIT, :DOWNC:INIT, :STEPATT:INIT, :TESTS:INIT
*CLS		clear status byte, no response.

SCPI Vocabulary of LSNA, release 3.02, 2/5

:FRACn		
:INITialize		initialize the FracN subsystem
:FREQuency	x|?	set/ask for frequency (Hz) 10 000 000 <= x <= 20 000 000
:VCOFrequency	?	ask for VCO freq
:NDOTFDivisor	?	ask for NDOTF divisor
:REFDivisor	?	ask for REF divisor
:POSTDivisor ?		ask for POST divisor
:DATA	x|?	send/get a data byte to the fracn, if low-level commands are allowed. 0 <= x <= 15
:CMD	x	send a command to the fracn, if low-level commands are allowed 0 <= x <= 15

SCPI Vocabulary of LSNA, release 3.02, 3/5

:DOWNConverter

:INITialize — initialize the downconverter subsystem (both boards)

:GAINdb

CHn x|? — set/ask for the gain of channel n 1<=n<=4 -6<= x <=36 values allowed -6 0 6 12 18 24 30 36, other values generate an error message. Warning ! if a DC offset is set, this command does not change the DC Offset binary value, thus it modifies the DC offset voltage value.

[ALL] x — set the gain of all channels -6 <= x <= 36

:OFFSETDCVolt

CHn ? — ask for the approximative DC offset voltage channel of channel n 1<=n<=4. Warning ! this offset is modified by the gain of the considered channel.

:OFFSETDCBin

CHn x|? — set/ask the binary value of channel n DC offset 1<= n <= 4 -2048 <= x <= 2047. Table of DC offsets :

Gaindb	x	V	x	V	x	V
-6 dB	-2048	0.23	0	0.0	2047	-0.23
0 dB	-2048	0.46	0	0.0	2047	-0.46
6 dB	-2048	0.93	0	0.0	2047	-0.93
12 dB	-2048	1.86	0	0.0	2047	-1.86

Notice that absolute DC offset should not be larger than 2 Volts, because clipping/overload can occur.

[ALL] x — set the binary value of DC offset for all channel

SCPI Vocabulary of LSNA, release 3.02, 4/5

:STEPATTenuator

:INITialize — initialize the step attenuators subsystem (each stage)

:ATTENdb

CHn x|? — set/ask for the attenuation of channel 1 0 <= x <= 70 values allowed 0 10 20 30 40 50 60 70, other not taken into account. 1 <= n <= 4

ALL x — set the attenuation of all channels 0 <= x <= 70

x — set the attenuation of all channels 0 <= x <= 70

:TESTSet

:INITialize — initialize the test-set subsystem

:SUPPORTEDModes ? — ask for the list of supported modes. Values are: MEASURE, MEASURE_REFgen, FORWARD_PORT1, FORWARD_PORT2, REFGEN_PORT1, REFGEN_PORT2, FORWARD_AUX1, FORWARD_AUX2, REFGEN_AUX1, REFGEN_AUX2

:MODE s|? — set/ask the test-set mode. s is one of the supported modes If a wrong mode message is given, nothing is done, but 1 and an error message are returned

SCPI Vocabulary of LSNA, release 3.02, 5/5

:SYSTem		
:INITialize		initialize the embedded processor system, each relaydriver is open (no current in coils) and each programmable I/O line is configured as input. When other subsystemare initialized, the relevant I/O lines and relay drivers are properly set. The RS232 baud rate is set, and the GPIB address to.
:VERSion	?	return the software release number.
:PARAMeter		
:GPIBADdress x|?		set/ask for GPIB address 1 <= x <= 31 Interface setup after next *RST or :System: Init or power-up
:RS232CBaud x|?		set/ask for RS232c Baud rate. Allowed values are 1200, 2400, 4800, 9600, 19200. Allways Null modemwith no parity, 1 stop, 8 bits. Interface setup after next *RST or :System: Init or power-up
:SERIal	?	ask for the hardware serial number
:SERVice		……..

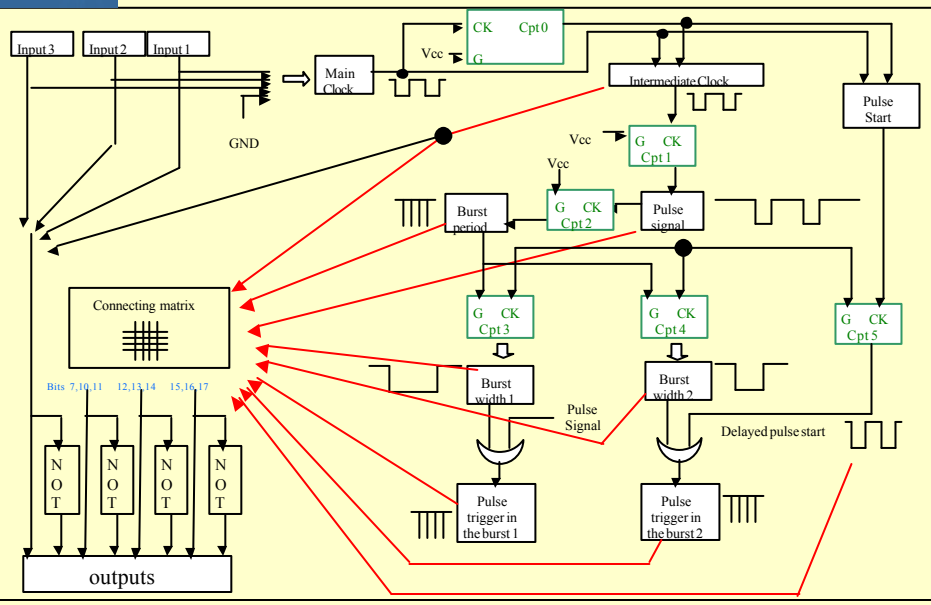
WHY a new PCB for PULSE measurements ?

For very high power characterizations of devices, pulse meas. are frequently the only way to proceed.

The usual problem of pulse measurements is the triggering

In the particular case of the LSNA, we need a repetitive signal. It means the pulses have to be related (an integer ratio) to the RF sampling. Moreover, if the pulses and the ADC clock are linked, some interesting properties can appear (simplification)

Our new board is to be plugged on top of PC 104 stack, the LSNA SCPI vocabulary has been extended to control it



« pulse » card ⇒ Trig the samplers

Large choice of pulse parameters

1 input among 3

- *Choice of main clock*
- *Settings :*
  - Optional first frequency division
  - time between two pulses
  - time between two bursts
  - Number of pulses in a burst
  - delay between two different pulse groups
  - Optional independent trigger of bursts groups

Moreover : signals connection matrix to outputs !

Examples of available time scales :

- 2 pulses of 200 µs every 6 ms
- 5 pulses of 600 ns separated by 5 µs every minute

SCPI Vocabulary of LSNA, PULSEBoard section 1/2

PULSEBoard		
:INITialize		Initialize all the pulse hardware. If hardware is present, sets NORMal mode
:SUPPORTEDModes ?		ask for different available modes. Values are : NONe, NORMal, PULSe, BURst
:MODE	s|?	set/ask the pulse card mode. s is one of the supported modes of the actual pulsecard.
:PULSE		
:CLOCKSELection	s|?	set/get the selected clock for pulses (and bursts). Can be CKIN1, CKIN2, CKIN3.
:CLOCKDIVision	x|?	set/get the pulse period as a division factor of the selected clock. 2 + CLOCKDELay <= x <= 65535
:CLOCKDELay	x|?	set/get the delay of the delayed output as a number of cycles. 0 <= x <= CLOCKDIVision-1
:FREQuency	?	computes the pulse frequency, result in Hz
:TIMEPeriod	?	computes the pulse period, result in second
:TIMEDelay	?	computes the delay, result in second

SCPI Vocabulary of LSNA, PULSEBoard section 2/2

PULSEBoard		
:BURST		
:CLOCKPERiod	s|?	set/get the burst period as a number of pulse periods. 2 <= x <= 65535
:CLOCKDURation	s|?	set/get the burst duration as a number of pulse periods. 2 <= x <= CLOCKPERiod-1
:FREQuency	?	computes the burst frequency, result in Hz
:TIMEPeriod	?	computes the burst period, result in second
:TIMEDuration?		computes the burst active duration, result in second
:ADC		
:CLOCKSelection	s|?	set/get the selected clock for the ADC outputs (output 1 and 2). Can be CKIN1, CKIN2, CKIN3. Default is CKIN1
:FREQuency	?	get the clock frequency at output 1 or 2, result in Hz

Availability of the work

This work is provided for free by IRCOM, the board layout, the code and the documentation. Call me.

BUT

-It will only work in recent LSNA with the digital control based on the embedded PC (not with VXI controller)

-We DO NOT provide any guarantee of support, hardware or software

-People interested by this enhancement should contact NMDG in order to get hardware and software support

FUTURE

We plan to redesign the pulse board with an embedded synthesizer (a DDS component) in order to avoid the need of another FracN to control accurately the ADC clock.

Later, we plan to redesign completely the embedded PC of the LSNA, with :
- a much more powerful operating system (Linux instead of DOS)

- a LAN interface in addition with the GPIB

- internal ADCs and DSP.