Test Report DYPB.B31L7

General information

Position code	DYPB.B31L7=R71
Test date	**6 Dec 2005**
Fip bus address	195
Selected heater firing	DISABLED
DQAMC firmware version:	5.5
DQQDL firmware version:	3.7

Equipment in the rack

Rack	HCDYPB_001-EI000389
Electrical connection box	HCDJPB001-CH000068
Local Protection Unit	HCDQLPU001-EL000255
Quench heater power supply 1	HCDQHDS001-EL001137
Quench heater power supply 2	HCDQHDS001-EL001735
Quench heater power supply 3	HCDQHDS001-EL001143
Quench heater power supply 4	HCDQHDS001-EL001085

Summary of warnings

NEGATIVE TEST Circuit 0 board 0	Voltage or flag incoherence in sample: 400 !
VOLTAGE THRESHOLD - TIME DISCRIMINATOR Circuit 0 board 1 aperture 0	Time vector not coherent in sample 1062!
VOLTAGE THRESHOLD - TIME DISCRIMINATOR Circuit 0 board 0 aperture 1	Time vector not coherent in sample 1207!
VOLTAGE THRESHOLD - TIME DISCRIMINATOR Circuit 0 board 1 aperture 1	Time vector not coherent in sample 1639!
200 V TRANSFER FUNCTION Circuit 0 board 0 aperture 0	RMS error: 28.3532
200 V TRANSFER FUNCTION Circuit 0 board 0 aperture 1	Time vector not coherent in sample 2509!
200 V TRANSFER FUNCTION Circuit 0 board 0 aperture 1	RMS error: 23.2511
200 V TRANSFER FUNCTION Circuit 0 board 1 aperture 1	Time vector not coherent in sample 170!

1 Tested functionalities

1.1 Initial temperature

The microcontroller chip temperature at the beginning of the test is measured. It should be lower than 55 °C. The DQAMC temperature is a rough measurement of the temperature of the agent while the DQQDL temperature gives an estimation of the temperature of the quench detection boards.

Chip	Temperature (°C)	Test message
DQQDL A	20	OK
DQQDL B	20	OK
DQAMC	18	OK

1.2 Calibration

Before starting the test the input voltage to the apertures is set to 0V and the calibration command is tested. The measured voltage should be below 4mV. The test may be accpeted with a zero voltage up to 10mV, depending on the results obtained in the other sections.

Circuit	Board	UQS0 at calibration (V)	Test message
0	A	0.001	OK
0	B	-0.001	OK

1.3 Positive Test Mode

The POSITIVE_TEST_MODE command as well as the response that it generates are tested. The quench time should be around 1000 ms. All the values for the flag timings are referred to the quench time. The coherence of the flags with the analog values is also tested. A plot corresponding to the voltage generated is available in the plots section at the end of the document.

positive_test_mode Circuit 0, Board A				
Data file	POST_MORTEM_0_2005_12_06_11_24_33.txt			
Quench time (ms)	1000			
Time vector	OK			
U_QS0 at quench	0.104 V			
Flag	Initial value	Changes	Comment	Status
DQQDL:ST_COHER_OK	1	NO		OK
MB:ST_MAGNET_OK	1	-15 ms	Latched for 1245 ms	OK
MB:ST_NQD0	1	N/A	Coherent	OK
DQQDL:ST_PWR	1	NO		OK
DQQDL:ST_PWR_PERM	0	N/A	Coherent	OK
DQAMC:ST_BUS	1	NO		OK
DQAMC:ST_COM	1	NO		OK
DQAMC:ST_PWR_PERM	1	NO	Coherent	OK

positive_test_mode Circuit 0, Board B				
Data file	POST_MORTEM_0_2005_12_06_11_27_34.txt			
Quench time (ms)	996			
Time vector	OK			
U_QS0 at quench	0.099 V			
Flag	Initial value	Changes	Comment	Status
DQQDL:ST_COHER_OK	1	NO		OK
MB:ST_MAGNET_OK	1	-1 ms	Latched for 1220 ms	OK
MB:ST_NQD0	1	N/A	Coherent	OK
DQQDL:ST_PWR	1	NO		OK
DQQDL:ST_PWR_PERM	1	N/A	Coherent	OK
DQAMC:ST_BUS	1	NO		OK
DQAMC:ST_COM	1	NO		OK
DQAMC:ST_PWR_PERM	1	NO	Coherent	OK

1.4 Negative Test Mode

The NEGATIVE_TEST_MODE command as well as the response that it generates are tested. The quench time should be around 1000 ms. All the values for the flag timings are referred to the quench time. The coherence of the flags with the analog values is also tested. A plot corresponding to the voltage generated is available in the plots section at the end of the document.

NEGATIVE_TEST_MODE Circuit 0, Board A				
Data file	POST_MORTEM_0_2005_12_06_11_30_57.txt			
Quench time (ms)	999			
Time vector	OK			
U_QS0 at quench	-0.103 V			
Flag	Initial value	Changes	Comment	Status
DQQDL:ST_COHER_OK	1	NO		OK
MB:ST_MAGNET_OK	1	-9 ms	Latched for 1245 ms	OK
MB:ST_NQD0	1	N/A	Coherent	OK
DQQDL:ST_PWR	1	NO		OK
DQQDL:ST_PWR_PERM	1	N/A	Incoherent in sample 400	WARNING
DQAMC:ST_BUS	1	NO		OK
DQAMC:ST_COM	1	NO		OK
DQAMC:ST_PWR_PERM	1	NO	Coherent	OK

NEGATIVE_TEST_MODE **Circuit 0, Board B**				
Data file	POST_MORTEM_0_2005_12_06_11_33_57.txt			
Quench time (ms)	1000			
Time vector	OK			
U_QS0 at quench	-0.104 V			
Flag	Initial value	Changes	Comment	Status
DQQDL:ST_COHER_OK	1	NO		OK
MB:ST_MAGNET_OK	1	-15 ms	Latched for 1225 ms	OK
MB:ST_NQD0	1	N/A	Coherent	OK
DQQDL:ST_PWR	1	NO		OK
DQQDL:ST_PWR_PERM	1	N/A	Coherent	OK
DQAMC:ST_BUS	1	NO		OK
DQAMC:ST_COM	1	NO		OK
DQAMC:ST_PWR_PERM	1	NO	Coherent	OK

1.5 Verification of the Quench Detection Threshold Voltages

Two ramp signals (positive and negative) are sent to every aperture in the DQLPU. The voltage at which the quench is detected is recorded. The following table lists these voltage for each aperture, board and circuit in the DQLPU. The nominal threshold voltages are $\pm 100mV$.

Circuit	Board	Aperture	Thresholds (V)
0	A	0	0.1002
0	A	0	-0.1016
0	A	1	0.1023
0	A	1	-0.1009
0	B	0	0.1010
0	B	0	-0.0995
0	B	1	0.1015
0	B	1	-0.1015

1.6 Quench Detector Discriminator Time

The discriminator time is estimated in each board. The measurement is not very precise. The real value is $10.5ms$ but the values measured may vary from $8ms$ to $12ms$.

Circuit	Board	Discriminator time (ms)
0	A	11
0	B	12

1.7 Interlock continuity and quench reaction

The test did not show any discontinuity in the interlock and selected heater firing wiring inside the rack. The QUENCH_STATUS interlock was triggered by quenches detected in either board A or B.

1.8 Charge of the DQHDS

A test was performed on the DQHDS timing of charge up to a voltage higher than 810 V. Several charges were performed. They appear in the plots section at the end of this document.

1.9 Triggering of the DQHDS

In this section we tested the discharge parameters of the DQHDS as well as the response to quenches detected from boards A and B separately. The following table lists the calculated discharge parameters. The parameter τ is the time constant of the discharge and C the total capacitance of the HDS. The supplies were discharged over a 12.0 Ω resistance.

Discharge parameters				
Device	Max (V)	Min (V)	τ (ms)	C (mF)
UHDS1	882	3	70	6.58
UHDS2	879	4	70	6.51
UHDS3	873	3	70	6.565
UHDS4	879	3	70	6.43

The followoing tables summarize the response of the detector to the quench signal sent to the concerned input. The quench signal consists of a floating voltage ramp ranging from 75 mV to 130 mV sent to aperture 0 of the concerned board. All boards are checked to be sure that they all can trigger the discharge on time. The time t_i represents the time elapsed between the detection of the quench and the beginning of the discharge for DQHDSi.

DQHDS **triggering Circuit 0, Board A**				
Data file	POST_MORTEM_0_2005_12_06_13_47_37.txt			
Quench time (ms)	1000			
Time vector	OK			
U_QS0 at quench	0.101 V			
t_1 (ms)	10			
t_2 (ms)	10			
t_3 (ms)	10			
t_4 (ms)	10			
Flag	Initial value	Changes	Comment	Status
DQQDL:ST_COHER_OK	1	NO		OK
MB:ST_MAGNET_OK	1	-5 ms	Latched for 1270 ms	OK
MB:ST_NQD0	1	N/A	Coherent	OK
DQQDL:ST_PWR	1	NO		OK
DQQDL:ST_PWR_PERM	1	N/A	Coherent	OK
DQAMC:ST_BUS	1	NO		OK
DQAMC:ST_COM	1	NO		OK
DQAMC:ST_PWR_PERM	1	NO	Coherent	OK
MB:ST_PWR_PERM	1	N/A	Coherent	OK

DQHDS **triggering Circuit 0, Board B**				
Data file	POST_MORTEM_0_2005_12_06_13_56_48.txt			
Quench time (ms)	996			
Time vector	OK			
U_QS0 at quench	0.103 V			
t_1 (ms)	9			
t_2 (ms)	9			
t_3 (ms)	9			
t_4 (ms)	9			
Flag	Initial value	Changes	Comment	Status
DQQDL:ST_COHER_OK	1	NO		OK
MB:ST_MAGNET_OK	1	-6 ms	Latched for 1235 ms	OK
MB:ST_NQD0	1	N/A	Coherent	OK
DQQDL:ST_PWR	1	NO		OK
DQQDL:ST_PWR_PERM	1	N/A	Coherent	OK
DQAMC:ST_BUS	1	NO		OK
DQAMC:ST_COM	1	NO		OK
DQAMC:ST_PWR_PERM	1	NO	Coherent	OK
MB:ST_PWR_PERM	1	N/A	Coherent	OK

1.10 Selected Heater Firing Command

The selected heater firing switches were tested and it was checked that a quench would activate the selected heater firing corresponding to the programmed interlock (even, odd or none). The timing was not tested.

1.11 Internal Discharge of the DQHDS

After the test of the DQHDS they are switched off and the natural discharge is recorded. Refer to the corresponding plot at the end of the report.

1.12 Transfer functions

To evaluate the accuracy of the measurement of the analog voltages, known ramp signals were sent to each aperture and each board in the following aproximate ranges: $[-135mV, 135mV]$, $[-9.5V, 9.5V]$, $[-206V, 206V]$. In the first range U_QS0 was evaluated; the other ranges refer to U_1 and U_2, voltages in the apertures. The masured ramps are displayed in the plots section.
It is important that U_QS0 is a noise-free accurate signal (peak to peak noise $< 3mV$). The plot in $[-10V, 10V]$ may be noisy (pp noise $< 1V$) and some non-linearities may be present around $0V$ which are not critical. In the $[-200V, 200V]$ range some out-of-range values may appear in the extremes that are not relevant. A good linearity has to be assured though.

1.13 Final Temperature

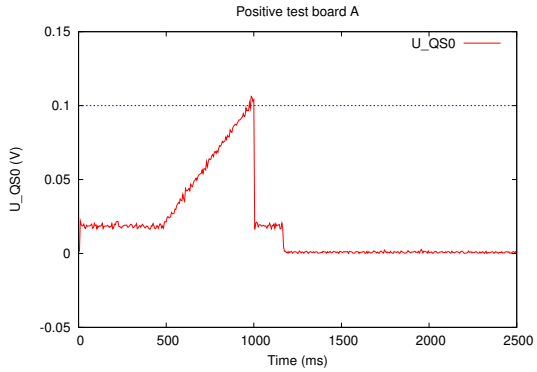
The temperature at the end of the test is measured. It should be lower than 55 °C. The DQAMC temperature is a rough measurement of the temperature of the agent while the DQQDL temperature

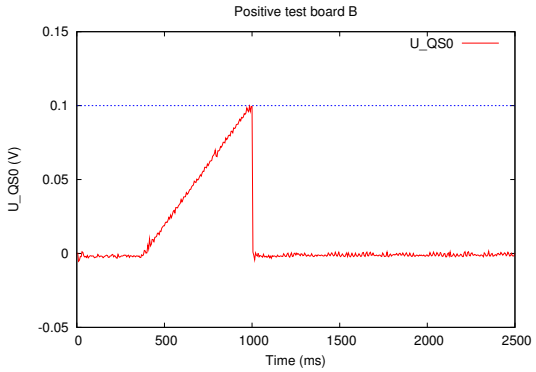
gives an estimation of the temperature of the quench detection boards.

Chip	Temperature (°C)	Test message
DQQDL A	38	OK
DQQDL B	38	OK
DQAMC	33	OK

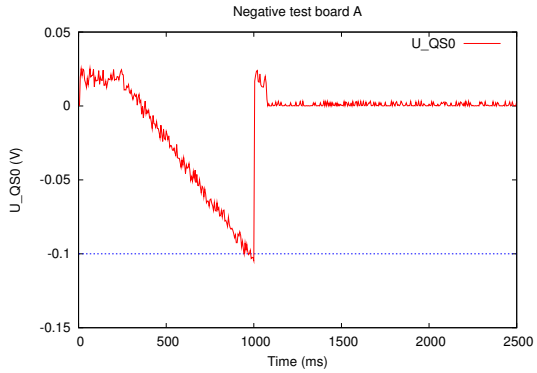
1.14 Plots

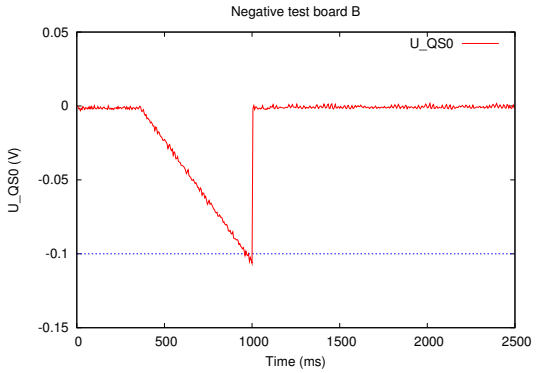
1.14.1 Positive test





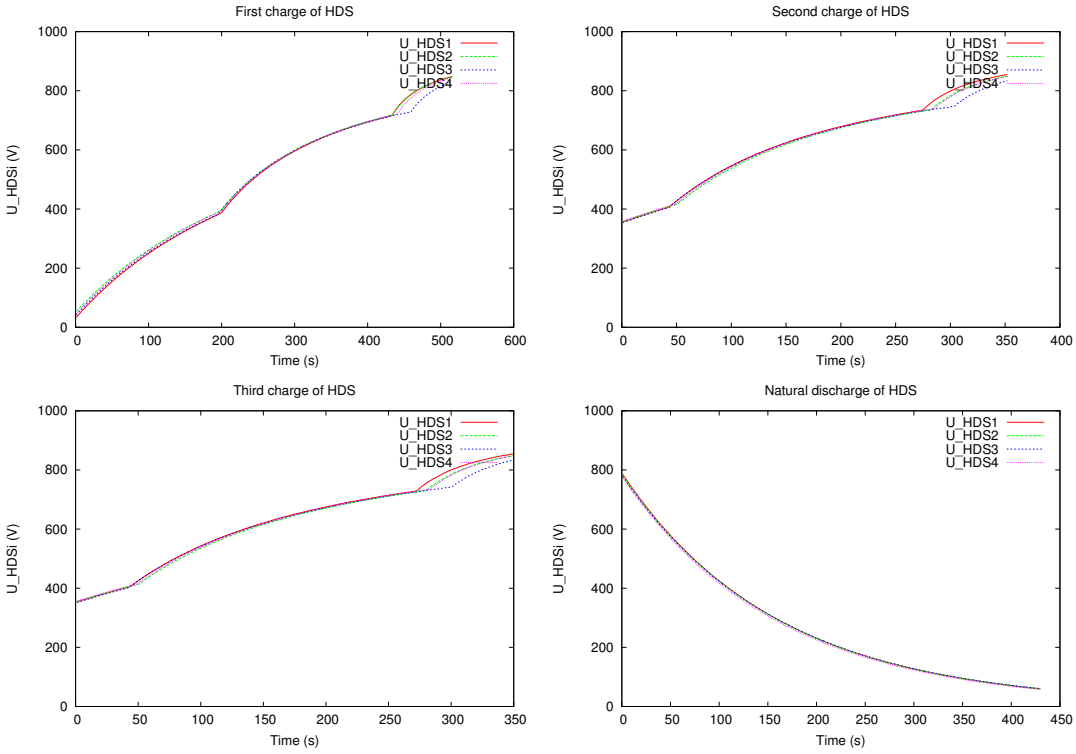
1.14.2 Negative test



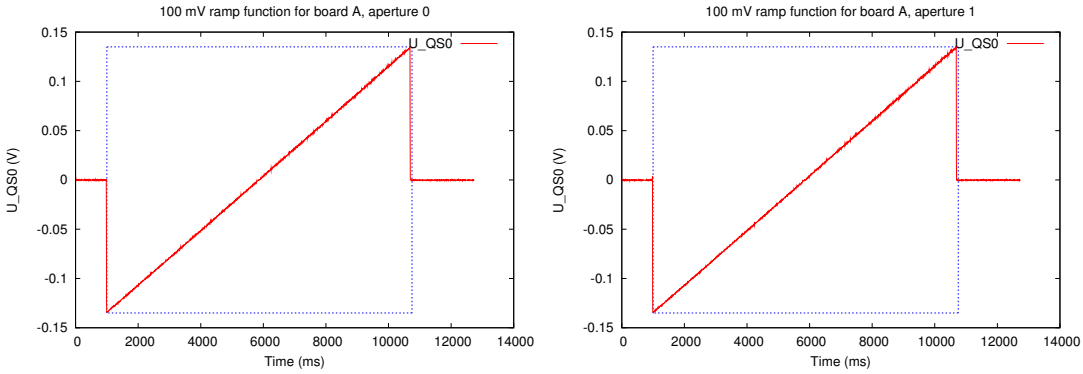


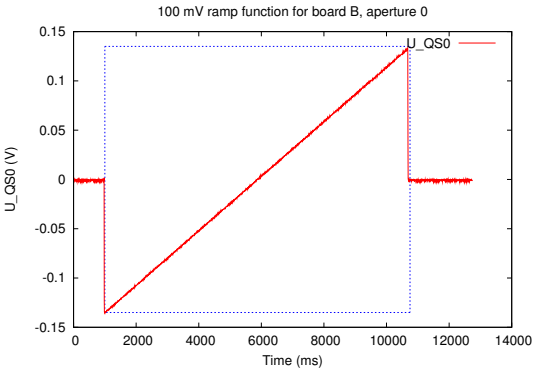
1.14.3 Charge and discharge of the HDS

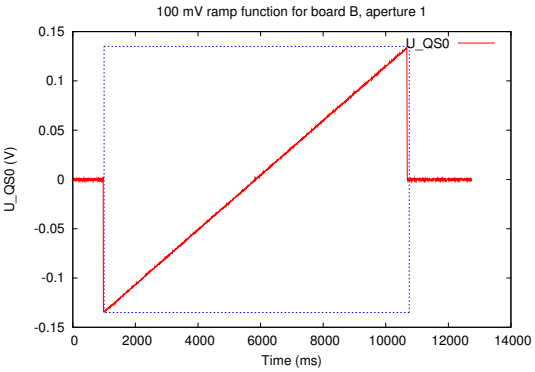
Note that charges 2 and 3 are recorded only after the previous post mortem file is generated and count less samples than charge 1.

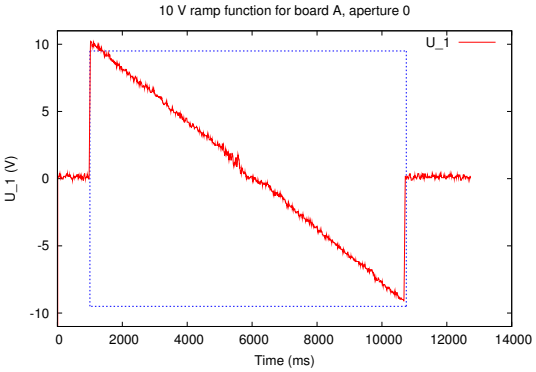


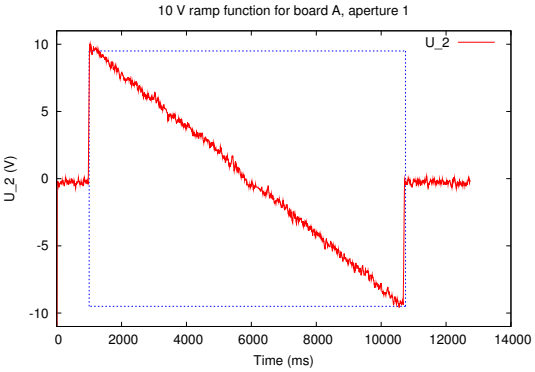
1.14.4 Transfer functions

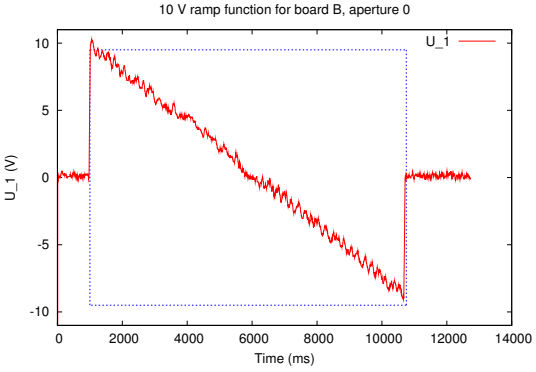


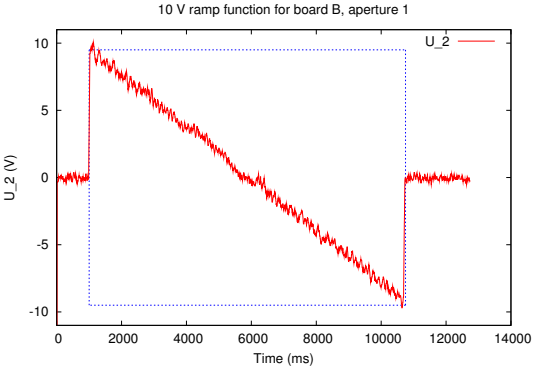

100 mV ramp function for board B, aperture 0
U_QS0
U_QS0 (V)
Time (ms)

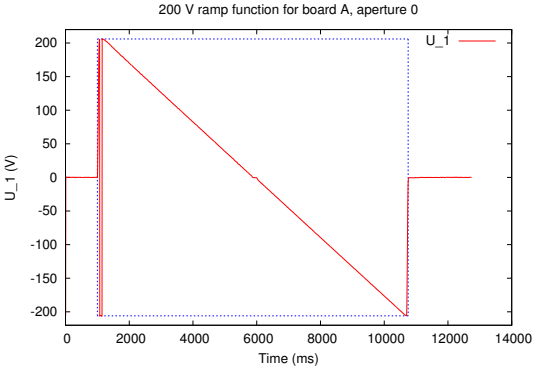

100 mV ramp function for board B, aperture 1
U_QS0
U_QS0 (V)
Time (ms)

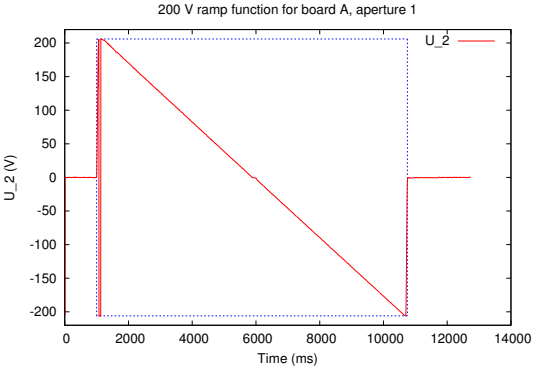

10 V ramp function for board A, aperture 0
U_1
U_1 (V)
Time (ms)

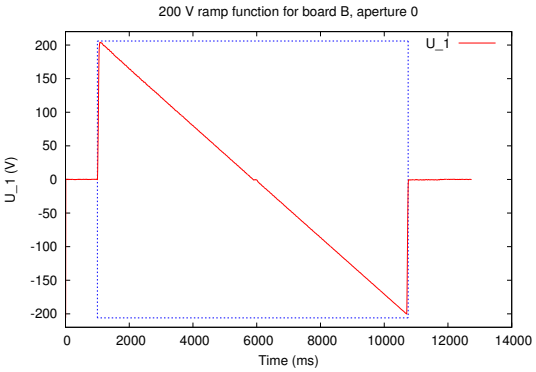

10 V ramp function for board A, aperture 1
U_2
U_2 (V)
Time (ms)

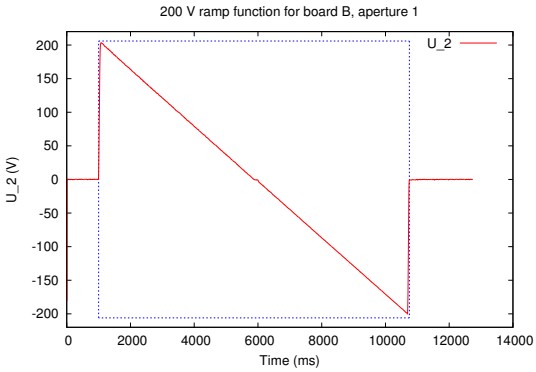

10 V ramp function for board B, aperture 0
U_1
U_1 (V)
Time (ms)


10 V ramp function for board B, aperture 1
U_2
U_2 (V)
Time (ms)


200 V ramp function for board A, aperture 0
U_1
U_1 (V)
Time (ms)


200 V ramp function for board A, aperture 1
U_2
U_2 (V)
Time (ms)


200 V ramp function for board B, aperture 0
U_1
U_1 (V)
Time (ms)
200
150
100
50
0
-50
-100
-150
-200
0
2000
4000
6000
8000
10000
12000
14000


200 V ramp function for board B, aperture 1
U_2
U_2 (V)
Time (ms)
200
150
100
50
0
-50
-100
-150
-200
0
2000
4000
6000
8000
10000
12000
14000