

2024-04-11

This document summarises the COLUTAV4 (CV4) MDAC calibration process.

Software that implements this process is here:

https://gitlab.cern.ch/feb2/gui-new/-/blob/b83c9c9b142a1130534a223424d396c3bf2df5d9/feb2_gui/controller/calibration_module.py#L363

The CV4 datasheet is here:

https://twiki.nevis.columbia.edu/twiki/pub/ATLAS/COLUTAv4Testboard/COLUTAV4_ds.pdf

The CV4 slow control bits relevant to the MDAC calibration are summarised below:

Configuration Name	Datasheet Description	Global or Channel Bits	Slow Control Bit # or range
CALFORCESR	MDAC:CAL_FORCESR	Channel	527
CALFORCEDAC	MDAC:CAL_FORCEDAC	Channel	518
CALSRVAL	MDAC:CAL_SRVAL	Channel	526:519
CALDACP	MDAC:CAL_DACP	Channel	517:510
CALDACM	MDAC:CAL_DACM	Channel	509:502
MDACCorrectionCode0	DDPU: MDAC Correction Code 0	Channel	171:155
MDACCorrectionCode1	DDPU: MDAC Correction Code 1	Channel	188:172
MDACCorrectionCode2	DDPU: MDAC Correction Code 2	Channel	205:189
MDACCorrectionCode3	DDPU: MDAC Correction Code 3	Channel	222:206
MDACCorrectionCode4	DDPU: MDAC Correction Code 4	Channel	239:223
MDACCorrectionCode5	DDPU: MDAC Correction Code 5	Channel	256:240
MDACCorrectionCode6	DDPU: MDAC Correction Code 6	Channel	273:257
MDACCorrectionCode7	DDPU: MDAC Correction Code 7	Channel	290:274

During the calibration process these configuration bits must be set for each CV4 channel to be calibrated. If calibrating multiple channels simultaneously then these configuration bits must be set for each channel

Step 0: Initialization

-set CALFORCESR = 1

-set CALFORCEDAC = 1

- set all MDAC correction codes to 0
- MDACCorrectionCode0 = 0000000000000000
- MDACCorrectionCode1 = 0000000000000000
- MDACCorrectionCode2 = 0000000000000000
- MDACCorrectionCode3 = 0000000000000000
- MDACCorrectionCode4 = 0000000000000000
- MDACCorrectionCode5 = 0000000000000000
- MDACCorrectionCode6 = 0000000000000000
- MDACCorrectionCode7 = 0000000000000000
- write and read back these configuration bits to/from the COLUTAs

Step 1: Low VCM measurements

COLUTA Test Mode #	CALSRVAL	CALDACP	CALDACM
1a	0	0	254
1b	1	0	254
2a	1	1	252
2b	3	1	252
3a	3	3	248
3b	7	3	248
4a	7	7	240
4b	15	7	240
5a	15	15	224
5b	31	15	224
6a	31	31	192
6b	63	31	192
7a	63	63	128
7b	127	63	128
8a	127	127	0
8b	255	127	0

- for each test mode do the following
- set the CALSRVAL, CALDACP and CALDACM bits to the values specified in the table
- write and read back these configuration bits to/from the COLUTAs
- record waveform data to file

Step 2: High VCM measurements

COLUTA Test Mode #	CALSRVAL	CALDACP	CALDACM
1a	0	1	255
1b	1	1	255
2a	1	3	254
2b	3	3	254
3a	3	7	252
3b	7	7	252
4a	7	15	248
4b	15	15	248
5a	15	31	240
5b	31	31	240
6a	31	63	224
6b	63	63	224
7a	63	127	192
7b	127	127	192
8a	127	255	128
8b	255	255	128

- for each test mode do the following
- set the CALSRVAL, CALDACP and CALDACM bits to the values specified in the table
- write and read back these configuration bits to/from the COLUTAs
- record waveform data to file

Step 4: Done

- at this point the configuration process is done
- reconfigure the CV4s to their standard settings to take normal data again