

Task: The task is to be able to load the Monsoon system down by making a CBB static load board and a CCD static load board. Each board will represent the static power consumed by a real board in it's place. With the boards, we can populate the rest of the system which will consume the same amount of current as the real boards. This configuration will help us perform noise measurements on the entire system without having the real boards in-hand.

Table 1 contains values I measured on our monsoon system. 1mcb, 1ccd, 1cbb, 1 fan, 1 uci. I use this table to calculate the current consumption for each board.

Table 2 lays out Uoff/Fnals peak power vs. NOAO to see how close the numbers are.

Table 3 calculates the loads required for each board including an estimate of the change in load going from the 8 channel board to the 12 channel board. These loads should represent the peak power consumption each board consumes in the system. The peak values don't include any power-up surges, only operational currents.

Table 4 calculates the power consumption for a 6-slot system fully populated using the 8 channel ccd acq. board.

Table 5 calculates the power consumption for a 6-slot system fully populated using the 12 channel ccd acq. board.

Both tables also calculate the external loads required to get the supply to 85%. These external loads are additional loads outside of the monsoon system. These numbers will change again when the new CBB board is built and it's current consumption is measured.

If Vicor converterpacks prove to be quiet only with the addition of an external load, then we will need to purchase new converterpacks with the proper power output specification.

Environment:
PAN Using on cyclone/home/cfg/_final focal plane.
Using sequence code ReadType1d.ucd
CBB 32 clk channels, 8 fast bias channels, & 36 slow bias channels
Clock & Bias channels are left open & not terminated.
CCD 8 video channels, 32 slow bias channels
Only channels 0 & 2 are being used. No slow bias channels are on.
Only channels 0 & 2 are terminated. The others are floating.

Table 1: Measured Values: Power-up current surges were not measured.

| Supply Voltages | Measured Voltages | Current Measurements (Amps) | | | | | | | | |
|-----------------|-------------------|-----------------------------|----------------|------------|-----------------|-----------------------|-----------------------------|----------------------|----------------------------|----------------------------------|
| | | Backplane Only | Backplane +FAN | Fan Only | Backplane + MCB | Backplane + MCB + CBB | Backplane + MCB + CBB + CCD | Backplane +FAN + MCB | Backplane +FAN + MCB + CBB | Backplane +FAN + MCB + CBB + CCD |
| +5vd | 4.69 | 0.00000096 | 0.65600000 | 0.65599904 | 0.66200000 | 0.82470000 | 0.87690000 | 0.89220000 | 1.11500000 | 1.17600000 |
| +3.3vd | 3.192 | 0.00000012 | 0.00000014 | n/a | 1.56500000 | 1.62600000 | 1.65600000 | 1.57300000 | 1.64000000 | 1.64000000 |
| +5va | 4.53 | 0.00000007 | 0.00000005 | n/a | 0.00000005 | 0.29340000 | 0.89210000 | 0.00000005 | 0.29600000 | 0.94630000 |
| +5va | 4.75 | 0.00000123 | 0.00000138 | n/a | 0.00000138 | 0.01220000 | 0.34310000 | 0.00000138 | 0.01036000 | 0.35030000 |
| +15va | 14.91 | 0.00000024 | 0.00000023 | n/a | 0.00000023 | 0.12200000 | 0.53800000 | 0.00000023 | 0.13700000 | 0.54800000 |
| +15va | 14.93 | 0.00000021 | 0.00000024 | n/a | 0.00000024 | 0.19000000 | 0.43000000 | 0.00000024 | 0.18620000 | 0.43000000 |
| +48va | 48 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| -28va | 28 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |

Table 2: Calculated Values: Peak currents during operation, NOT POWER-UP.

| Supply Voltages | Measured Voltages | Power Calculations for each board | | | | | | | | | | | | | | | |
|--------------------|-------------------|-----------------------------------|------------------|---------------|------------------|-------------------------|----------------------------|--------------------------|-----------------------------|---------------|---------------|---------------|---------------|--------------------|--------------------|--------------------------|--------------------------|
| | | Current (Amps) | | | | | Wattage (Watts) | | | | | | | | | | |
| | | Uoff Peak MCB | NOAO Average MCB | Uoff Peak CBB | NOAO Average CBB | Uoff Peak 8 Channel CCD | NOAO Average 8 Channel CCD | Uoff Peak 12 Channel CCD | NOAO Average 12 Channel CCD | Uoff MCB Only | NOAO MCB Only | Uoff CBB Only | NOAO CBB Only | 8 Channel CCD Only | 8 Channel CCD Only | Uoff 12 Channel CCD Only | NOAO 12 Channel CCD Only |
| +5vd | 4.69 | 0.2362 | 0.3800 | 0.2228 | 0.2400 | 0.0610 | 0.7600 | 0.8000 | 1.108 | 1.045 | 1.126 | 0.026 | 0.096 | 0.213 | 0.351 | 0.6384 | 3.752 |
| +3.3vd | 3.192 | 1.5650 | 1.3200 | 0.0083 | 0.0300 | 0.0667 | 0.1100 | 0.2000 | 4.213 | 0.026 | 0.096 | 0.213 | 0.351 | 3.141 | 1.449 | 4.83 | 4.83 |
| +5va | 4.53 | 0.0000 | 0.0000 | 0.0000 | 0.2960 | 0.3800 | 0.6503 | 0.3000 | 1.000 | 0.000 | 0.000 | 1.430 | 1.835 | 3.141 | 1.449 | 4.83 | 4.83 |
| +5va | 4.75 | 0.0000 | 0.0000 | 0.0104 | 0.0500 | 0.3398 | 0.3000 | 0.9000 | 0.000 | 0.000 | 0.049 | 0.238 | 1.615 | 1.425 | 4.275 | 4.275 | 4.275 |
| +15va | 14.91 | 0.0000 | 0.0000 | 0.1370 | 0.1700 | 0.4110 | 0.3500 | 1.1000 | 0.000 | 0.000 | 2.043 | 2.535 | 6.128 | 5.219 | 16.401 | 16.401 | 16.401 |
| +15va | 14.93 | 0.0000 | 0.0000 | 0.1882 | 0.3000 | 0.2418 | 0.2300 | 0.7000 | 0.000 | 0.000 | 2.810 | 4.479 | 3.610 | 3.434 | 10.451 | 10.451 | 10.451 |
| +48va | 48 | | | 0.005 | 0.0030 | 0.005 | 0.0030 | 0.0030 | 0.000 | 0.000 | 0.240 | 0.144 | 0.240 | 0.144 | 4.200 | 4.200 | 8.68 |
| -28va | 28 | | | 0.0030 | 0.0030 | 0.1500 | 0.1500 | 0.3100 | 0.000 | 0.000 | 0.084 | 0.084 | 4.200 | 4.200 | 8.68 | 8.68 | 8.68 |
| Total Watts | | | | | | | | | | 6.103 | 5.996 | 7.727 | 10.536 | 19.433 | 19.786 | 49.171 | |

**: NOAO measured values for current using 8 channel CCD board and CBB board fully running
*: FNAL measured values for +48va, NOAO measured values for -28va

Conclusion: I can use the measured values from above with the values from the "12chPowerEstimate.xls" table to determine the load needed for each board.

Table 3: Loads needed for each board: The larger value between Uoff Peak and NOAO Average was used to determine the peak load for each board. 12 Channel CCD uses estimated currents to calculate Rload values.

| Supply Voltages | Measured Voltages | CBB Current | CBB RLOAD Ohms | CBB RLOAD Watts | CCD 8 Channel Current | CCD 8 Channel RLOAD Ohms | CCD 8 Channel RLOAD Watts | CCD 12 Channel Current | CCD 12 Channel RLOAD Ohms | CCD 12 Channel RLOAD Watts | Total Watts/Board | | | | | | | |
|--------------------------|-------------------|-------------|----------------|-----------------|-----------------------|--------------------------|---------------------------|------------------------|---------------------------|----------------------------|-------------------|-----------|--------------|-----------|--------------|-----------|--------------|--------|
| | | | | | | | | | | | | Uoff Peak | NOAO Average | Uoff Peak | NOAO Average | Uoff Peak | NOAO Average | |
| +5vd | 4.69 | 0.2400 | 19.542 | 1.126 | 0.7600 | 90.71 | 3.654 | 0.8000 | 5.863 | 3.752 | 27.0 | | | | | | | |
| +3.3vd | 3.192 | 0.0300 | 106.400 | 0.096 | 0.1100 | 20.018 | 0.351 | 0.2000 | 15.960 | 0.638 | 4.83 | | | | | | | |
| +5va | 4.53 | 0.3800 | 12.711 | 1.835 | 0.6503 | 7.427 | 3.141 | 1.0000 | 4.830 | 4.830 | 8 | | | | | | | |
| +5va | 4.75 | 0.0500 | 95.000 | 0.238 | 0.3399 | 13.973 | 1.615 | 0.9000 | 5.278 | 4.275 | 8 | | | | | | | |
| +15va | 14.91 | 0.1700 | 87.706 | 2.535 | 0.411 | 36.277 | 6.128 | 1.1000 | 13.555 | 16.401 | 16.401 | | | | | | | |
| +15va | 14.93 | 0.3000 | 49.77 | 4.479 | 0.2418 | 61.745 | 3.610 | 0.7000 | 21.329 | 10.451 | 10.451 | | | | | | | |
| +48va | 48 | 0.0050 | 9600.000 | 0.240 | 0.0050 | 9600.000 | 0.240 | 0.0050 | 9600.000 | 0.240 | 0.240 | | | | | | | |
| -28va | 28 | 0.0030 | 9333.333 | 0.084 | 0.1500 | 186.667 | 4.200 | 0.3100 | 90.323 | 8.680 | 8.68 | | | | | | | |
| Total Watts/Board | | | | | | | | | | | | 10.632 | | | 22.849 | | | 49.267 |

Table 4: Total current consumed using a 6-slot backplane fully loaded with 8 channel CCD Acq. boards, & external load resistors needed to run supply in 85% load:

| Monsoon System Voltages | Rated Supply Voltage Output | Rated Supply Current (A) | Rated Supply Power (W) | DHE Using 8 Channel CCD Acq. Boards | | | | | | External Load | | |
|-------------------------|-----------------------------|--------------------------|------------------------|-------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|-------------------------------|---------------------------------|------------------------------------|
| | | | | Total MCB Current (A) | Total CBB Current (A) | Total CCD Current (A) | 6-Slot DHE Current (A) | Total Current Load (%) | Total System Power (W) | Current Load To Reach 85% (A) | External RLOAD To Reach 85% (W) | External Ri Watts To Reach 85% (W) |
| +5vd | 5 | 10 | 50 | 0.3800 | 0.4800 | 2.2800 | 3.1400 | 31.40% | 15.70 | 5.3600 | 0.9328 | 27 |
| +3.3vd | 3.3 | 10 | 33 | 1.5650 | 0.0600 | 0.3300 | 1.9550 | 19.55% | 6.45 | 6.5450 | 0.5042 | 22 |
| +5va | 5 | 5 | 25 | 0.0000 | 0.7600 | 1.9509 | 2.7109 | 54.22% | 13.55 | 1.5391 | 3.2487 | 8 |
| +5va | 5 | 5 | 25 | 0.0000 | 0.1000 | 1.0198 | 1.1198 | 22.40% | 5.60 | 3.1302 | 1.5974 | 16 |
| +15va | 15 | 6.7 | 100.5 | 0.0000 | 0.3400 | 1.2300 | 1.5700 | 23.48% | 23.60 | 4.1220 | 3.6390 | 62 |
| +15va | 15 | 6.7 | 100.5 | 0.0000 | 0.6000 | 0.7254 | 1.3254 | 19.78% | 19.88 | 4.3696 | 3.4328 | 66 |
| +48va | 48 | 1 | 48 | 0.0000 | 0.0100 | 0.0150 | 0.0250 | 2.50% | 1.20 | 0.8250 | 58.1818 | 40 |
| -28va | 28 | 2.7 | 75.6 | 0.0000 | 0.0060 | 0.4500 | 0.4560 | 16.89% | 12.77 | 1.8390 | 15.2257 | 51 |

Table 5: Total current consumed using a 6-slot backplane fully loaded with 12 channel CCD Acq. boards, & external load resistors needed to run supply in 85% load:

| Monsoon System Voltages | Rated Supply Voltage Output | Rated Supply Current (A) | Rated Supply Power (W) | DHE Using 12 Channel CCD Acq. Boards | | | | | | External Load | | |
|-------------------------|-----------------------------|--------------------------|------------------------|--------------------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|-------------------------------|---------------------------------|------------------------------------|
| | | | | Total MCB Current (A) | Total CBB Current (A) | Total CCD Current (A) | 6-Slot DHE Current (A) | Total Current Load (%) | Total System Power (W) | Current Load To Reach 85% (A) | External RLOAD To Reach 85% (W) | External Ri Watts To Reach 85% (W) |
| +5vd | 5 | 10 | 50 | 0.3800 | 0.4800 | 2.4000 | 3.2600 | 32.60% | 16.30 | 5.2400 | 0.9542 | 26 |
| +3.3vd | 3.3 | 10 | 33 | 1.5650 | 0.0600 | 0.6000 | 2.2250 | 22.25% | 7.34 | 6.2750 | 0.5259 | 21 |
| +5va | 5 | 5 | 25 | 0.0000 | 0.7600 | 3.0000 | 3.7600 | 75.20% | 18.80 | 0.4900 | 10.2041 | 7 |
| +5va | 5 | 5 | 25 | 0.0000 | 0.1000 | 2.7000 | 2.8000 | 56.00% | 14.00 | 1.4500 | 3.4483 | 2 |
| +15va | 15 | 6.7 | 100.5 | 0.0000 | 0.3400 | 3.3000 | 3.6400 | 54.33% | 54.60 | 2.0550 | 7.2993 | 51 |
| +15va | 15 | 6.7 | 100.5 | 0.0000 | 0.6000 | 2.1000 | 2.7000 | 40.30% | 40.50 | 2.9950 | 5.0083 | 45 |
| +48va | 48 | 1 | 48 | 0.0000 | 0.0100 | 0.0150 | 0.0250 | 2.50% | 1.20 | 0.8250 | 58.1818 | 40 |
| -28va | 28 | 2.7 | 75.6 | 0.0000 | 0.0060 | 0.9300 | 0.9360 | 34.67% | 26.21 | 1.3590 | 20.6034 | 38 |