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# **NSLS-II CSX Beamline Docs Documentation**

***Release 0.1***

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## HELP!! THE %\$^\$#@% JUST CRASHED

### 1.1 Managing IOCs

Soft IOCs are managed through the `manage-iocs` script. To obtain a list of softiocs running on a NSLS-II computer use the command `manage-iocs report` an example is shown below for `xf23id1-ioc3`:

```
[swilkins@xf23id1-ioc3 ~]$ manage-iocs report
```

| nBASE       | IOC           | USER    | PORT | EXEC                             |
|-------------|---------------|---------|------|----------------------------------|
| /epics/iocs | apcupsd       | root    | 5000 | /epics/iocs/apcupsd/st.cmd       |
| /epics/iocs | cam-diag1     | softioc | 4202 | /epics/iocs/cam-diag1/st.cmd     |
| /epics/iocs | cam-diag6     | softioc | 4300 | /epics/iocs/cam-diag6/st.cmd     |
| /epics/iocs | cam-dif1      | softioc | 4204 | /epics/iocs/cam-dif1/st.cmd      |
| /epics/iocs | cam-dif2      | softioc | 4205 | /epics/iocs/cam-dif2/st.cmd      |
| /epics/iocs | cam-dif3      | softioc | 4206 | /epics/iocs/cam-dif3/st.cmd      |
| /epics/iocs | cam-dif-beam  | softioc | 4201 | /epics/iocs/cam-dif-beam/st.cmd  |
| /epics/iocs | ct-eps        | softioc | 4002 | /epics/iocs/ct-eps/st.cmd        |
| /epics/iocs | es-dg645      | softioc | 5013 | /epics/iocs/es-dg645/st.cmd      |
| /epics/iocs | es-K2611      | softioc | 4302 | /epics/iocs/es-K2611/st.cmd      |
| /epics/iocs | es-tctrl1     | softioc | 5010 | /epics/iocs/es-tctrl1/st.cmd     |
| /epics/iocs | es-vortex     | softioc | 4301 | /epics/iocs/es-vortex/st.cmd     |
| /epics/iocs | mc11          | softioc | 5001 | /epics/iocs/mc11/st.cmd          |
| /epics/iocs | mc12          | softioc | 5002 | /epics/iocs/mc12/st.cmd          |
| /epics/iocs | mc13          | softioc | 5003 | /epics/iocs/mc13/st.cmd          |
| /epics/iocs | omegaM4061    | softioc | 5012 | /epics/iocs/omegaM4061/st.cmd    |
| /epics/iocs | simdetector   | softioc | 4203 | /epics/iocs/simdetector/st.cmd   |
| /epics/iocs | simmotor      | softioc | 8001 | /epics/iocs/simmotor/st.cmd      |
| /epics/iocs | timestamp     | softioc | 6001 | /epics/iocs/timestamp/st.cmd     |
| /epics/iocs | va-bakeout-01 | softioc | 4001 | /epics/iocs/va-bakeout-01/st.cmd |
| /epics/iocs | zebra         | softioc | 5011 | /epics/iocs/zebra/st.cmd         |

To connect to the IOC console, telnet to localhost at the port that is shown in the table. For example to connect to the `mc12` console issue the command:

```
[swilkins@xf23id1-ioc3 ~]$ telnet localhost 5002
Trying ::1...
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
@@@ Welcome to procServ (procServ Process Server 2.6.0)
@@@ Use ^X to kill the child, auto restart is ON, use ^T to toggle auto restart
@@@ procServ server PID: 10584
@@@ Server startup directory: /epics/iocs/mc12
@@@ Child startup directory: /epics/iocs/mc12
@@@ Child "mc12" started as: /epics/iocs/mc12/st.cmd
@@@ Child "mc12" PID: 28044
```

```
@@@ procServ server started at: Tue Oct 20 17:35:25 2015
@@@ Child "mcl2" started at: Fri Nov 13 12:49:49 2015
@@@ 0 user(s) and 0 logger(s) connected (plus you)
```

In order to reboot the IOC, type [CTRL] + X. To leave the console type [CTRL] + ] and type `close` at the `telnet>` prompt

To start all IOCs configured on the system issue the command `sudo manage-iocs startall` and if needed to stop all IOCs issue the command `sudo manage-iocs stopall`

## 1.2 OLog Glassfish Server

To reboot the glassfish server on `xf23id-ca.cs.nsls2.local` execute:

```
swilkins@xf23id-ca:~$su - glassfish
glassfish@xf23id-ca:~$cd glassfish3/bin/
glassfish@xf23id-ca:~/glassfish3/bin$ ./asadmin stop-domain domain1
glassfish@xf23id-ca:~/glassfish3/bin$ ./asadmin stop-domain domain2
glassfish@xf23id-ca:~/glassfish3/bin$ ./asadmin start-domain domain1
glassfish@xf23id-ca:~/glassfish3/bin$ ./asadmin start-domain domain2
```



### 2.1.1 Introduction

The analogue CCD signal is digitized by a custom designed fCRIC. Each fCRIC has 16 analogue inputs and digitizes with 13 bit precision and had 16 bit dynamic range. This is accomplished by having 3 gain ranges of 8x, 4x and 1x with an auto gain feature. In order to allow negative charge injection. The ADC is biased at a value of approximately 4096 (0x1000 in hex) with the exact value dependent on the ADC channel. The gain settings are stored in the two most significant bits of each ADC reading. The schematic of a single fCRIC channel is shown in the *LBNL fCRIC Circuit Diagram*.

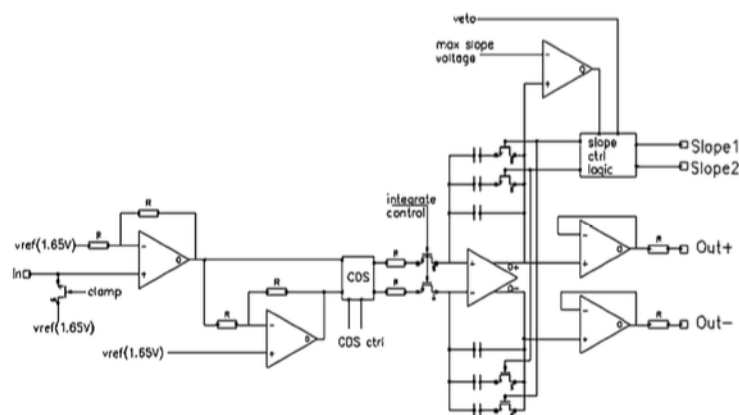


Fig. 2.1: LBNL fCRIC Circuit Diagram

The specifications of the CCD are summarized below:

- Pixel Size: 30  $\mu\text{m}$  x 30  $\mu\text{m}$
- Active Area: 1920 pixels (column) x 960 pixels (row)
- 192 super columns = 192 outputs (480 rows x 10 columns)
- Back illuminated
- 250  $\mu\text{m}$  - 350  $\mu\text{m}$  thickness
- Full well : ~900k  $e^-$  per pixel
- Sensitivity : 6  $e^-$  / ADU for 8x gain (max gain)
- Pixel readout time: 500  $\mu\text{s}$
- Digitization time: 2  $\mu\text{s}$  at 120 Hz
- 100 Hz maximum data collection

## 2.1.2 Data Format

In treating the raw CCD data from the FastCCD there are a few important considerations related to the multi-gain behaviour of the fCRIC amplifier and digitizer. The raw 16 bit values that are recorded in the data file follow the *16 Bit fCRIC Data Format* shown below with the two gain bits following the *fCRIC Gain Setting*.

Table 2.1: 16 Bit fCRIC Data Format

| 15 | 14 | 13  | 12  | 11  | 10  | 09  | 08  | 07  | 06  | 05  | 04  | 03  | 02  | 01  | 00  |
|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| G1 | G0 | ERR | D12 | D11 | D10 | D09 | D08 | D07 | D06 | D05 | D04 | D03 | D02 | D01 | D00 |

Table 2.2: fCRIC Gain Setting

| G1 | G0 | Gain | Pre-factor |
|----|----|------|------------|
| 0  | 0  | x8   | x1         |
| 1  | 0  | x2   | x4         |
| 1  | 1  | x1   | x8         |

Here the two most significant bits record the gain setting for the encoded value. The least significant 13 bits hold the measured analogue value. The actual value is therefore related to the measured value by:

$$A_{\text{corr}} = G(A_{\text{meas}} - O)$$

where  $A_{\text{corr}}$  is the corrected intensity,  $A_{\text{meas}}$  is the measured value by the ADC,  $G$  is the gain of the ADC and  $O$  is the bias offset.

## 2.1.3 Dark Image Subtraction

Due to the multi gain nature of the fCRIC it is therefore necessary to take 3 dark images at different gain settings to obtain the different ADC offsets under these modes. As the lower gain settings are not subject to considerable contribution due to dark current it is usually justifiable to measure only the highest gain dark image repeatedly. Given 3 dark images for the different gain settings the images the following python pseudo code can be used to correct for dark current and gain:

```
import numpy as np

def subtract_background(image, dark_image, gain = [1, 4, 8]):
    gain_mask_8 = (image & 0xC000) == 0xC000
    gain_mask_4 = (image & 0xC000) == 0x8000
    gain_mask_1 = (image & 0xC000) == 0x0000
```

```
cor_image = image.astype(np.float16)
cor_image -= gain_mask_8 * dark_image[2]
cor_image -= gain_mask_4 * dark_image[1]
cor_image -= gain_mask_1 * dark_image[0]

gain_image = (gain_mask_8 * gain[2]) + (gain_mask_4 * gain[1]) + (gain_mask_1 * gain[0])

return (cor_image * gain_image), gain_image
```

## 2.1.4 Useful Links

- [LBNL Fast CCD Site](#)
- [csxtools python analysis routines](#)
- [libcin low level c driver](#)
- [areaDetector Driver](#)



## INDICES AND TABLES

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