

libcin

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# Chapter 1

## FastCCD Communication Library (libcin)

### Introduction

This library, based in C is designed to control the FastCCD detector from Lawrence Berkeley National Laboratory. It controls both camera control functions and data acquisition (frame acquisition). It is separated into two distinct parts, the control part ,`cin_ctl`, and the data (image) part named `cin_data`. It was written in part for use with `areaDetector`.

### Prerequisites

The library relies on the following:

- `libconfig` (Used for nice config files)
- `libpthread` (Used for threading)
- `librt` (Used for time functions)

### Installation

Installation of the library is like most unix based source packages:

```
./make
./make doc
./make test
./make install
```

### TCP/IP Stack Tuning

In order for the CIN data to operate efficiently, the 10G interface on the host computer needs to be tuned. This needs to be done by adding the following to the file `/etc/sysctl.conf`.

```
# Increase the maximum buffer that user programs can request
# 2147483647 = 2048 Mb
net.core.rmem_max=2147483647
net.core.wmem_max=2147483647
# Set a default value 10 times bigger
net.core.rmem_default=1000000
net.core.wmem_default=1000000
# increase the length of the processor input queue
net.core.netdev_max_backlog = 250000
# recommended for hosts with jumbo frames enabled
net.ipv4.tcp_mtu_probing=1
```

These can be reread by the system without rebooting by entering the command:

```
$sudo sysctl --system
```

## Versioning

For the versions available, see the [tags on this repository](#).

## Authors

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See also the list of [contributors](#) who participated in this project.

## License

This project is licensed under the BSD License - see the [LICENSE](#) file for details

## Acknowledgments

A huge thanks to Peter Dennes, John Joseph and the detector team at LBNL and the team at Sydor Instruments.

## Chapter 2

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### 3.1 Class List

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### 4.1 File List

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src/ <b>common.h</b> . . . . .	??
src/ <b>config.h</b> . . . . .	??
src/ <b>control.h</b> . . . . .	??
src/ <b>data.h</b> . . . . .	??
src/ <b>descramble.h</b> . . . . .	??
src/ <b>descramble_map.h</b> . . . . .	??
src/ <b>fifo.h</b> . . . . .	??
src/ <b>report.h</b> . . . . .	??



## Chapter 5

# Module Documentation

### 5.1 Cin Control Initialization Routines

#### Functions

- int [cin\\_ctl\\_init](#) ([cin\\_ctl\\_t](#) \*cin, char \*addr, uint16\_t port, uint16\_t sport, char \*bind\_addr, uint16\_t bind\_port, uint16\_t bind\_sport)
- int [cin\\_ctl\\_destroy](#) ([cin\\_ctl\\_t](#) \*cin)
- void [cin\\_ctl\\_set\\_msg\\_callback](#) ([cin\\_ctl\\_t](#) \*cin, cin\_ctl\_msg\_callback callback, void \*ptr)
- int [cin\\_data\\_send\\_magic](#) ([cin\\_data\\_t](#) \*cin)

#### 5.1.1 Detailed Description

#### 5.1.2 Function Documentation

##### 5.1.2.1 [cin\\_ctl\\_destroy\(\)](#)

```
int cin_ctl_destroy (  
    cin\_ctl\_t * cin )
```

Destroy (close) the cin control library

Close connections, free memory and exit library

#### Parameters

<i>cin</i>	handle to cin library
------------	-----------------------

#### Returns

Returns 0 on success non-zero if error

### 5.1.2.2 cin\_ctl\_init()

```
int cin_ctl_init (
    cin_ctl_t * cin,
    char * addr,
    uint16_t port,
    uint16_t sport,
    char * bind_addr,
    uint16_t bind_port,
    uint16_t bind_sport )
```

Initialize the cin control library

Initialize the control structures and communications with the CIN via the control interface. This function opens the UDP ports and starts a listening thread to receive packets from the CIN.

#### Parameters

<i>cin</i>	handle to cin library
<i>addr</i>	ip address of CIN base address
<i>port</i>	UDP port of cin
<i>sport</i>	stream output UDP port of cin
<i>bind_addr</i>	ip address to bind to
<i>bind_port</i>	input udp port of cin
<i>bind_sport</i>	stream input udp port of cin

#### Returns

Returns 0 on success non-zero if error

### 5.1.2.3 cin\_ctl\_set\_msg\_callback()

```
void cin_ctl_set_msg_callback (
    cin_ctl_t * cin,
    cin_ctl_msg_callback callback,
    void * ptr )
```

Register a function to receive status messages

Close connections, free memory and exit library

#### Parameters

<i>cin</i>	handle to cin library
<i>callback</i>	function pointer to callback function
<i>ptr</i>	user pointer which is passed to callback routine

#### 5.1.2.4 cin\_data\_send\_magic()

```
int cin_data_send_magic (  
    cin_data_t * cin )
```

Send a magic packet to the CIN to initialize data

##### Parameters

<i>cin</i>	handle to cin library
------------	-----------------------

##### Returns

Returns 0 on success non-zero if error

## 5.2 Cin Control Read/Rwrite Routines

### Functions

- int [cin\\_ctl\\_read](#) ([cin\\_ctl\\_t](#) \*cin, uint16\_t reg, uint16\_t \*val)
- int [cin\\_ctl\\_write](#) ([cin\\_ctl\\_t](#) \*cin, uint16\_t reg, uint16\_t val, int wait)
- int [cin\\_ctl\\_stream\\_write](#) ([cin\\_ctl\\_t](#) \*cin, unsigned char \*val, int size)
- int [cin\\_ctl\\_write\\_with\\_readback](#) ([cin\\_ctl\\_t](#) \*cin, uint16\_t reg, uint16\_t val)

### 5.2.1 Detailed Description

### 5.2.2 Function Documentation

#### 5.2.2.1 cin\_ctl\_read()

```
int cin_ctl_read (
    cin\_ctl\_t * cin,
    uint16_t reg,
    uint16_t * val )
```

Read register from CIN

#### Parameters

<i>cin</i>	handle to cin library
<i>reg</i>	register to read
<i>val</i>	variable to read value of register to

#### Returns

Returns 0 on success non-zero if error

#### 5.2.2.2 cin\_ctl\_stream\_write()

```
int cin_ctl_stream_write (
    cin\_ctl\_t * cin,
    unsigned char * val,
    int size )
```

Write stream data to CIN

#### Parameters

<i>cin</i>	handle to cin library
<i>val</i>	array of values to write
<i>size</i>	size of array pointed to by val

Write stream data to cin in form of 16 bit array.

#### Returns

Returns 0 on success non-zero if error

##### 5.2.2.3 cin\_ctl\_write()

```
int cin_ctl_write (
    cin_ctl_t * cin,
    uint16_t reg,
    uint16_t val,
    int wait )
```

Write register to CIN

#### Parameters

<i>cin</i>	handle to cin library
<i>reg</i>	register to write to
<i>val</i>	value to write to register
<i>wait</i>	if non-zero

Write register value to CIN. If wait is non-zero then wait a sleep time of i CIN\_CTL\_WRITE\_SLEEP before releasing the mutex to add flow control to the cin.

#### Returns

Returns 0 on success non-zero if error

##### 5.2.2.4 cin\_ctl\_write\_with\_readback()

```
int cin_ctl_write_with_readback (
    cin_ctl_t * cin,
    uint16_t reg,
    uint16_t val )
```

Write register to CIN with readback verification

#### Parameters

<i>cin</i>	handle to cin library
<i>reg</i>	register to write to
<i>val</i>	value to write to register

Write register value to CIN. Follow write with read of register and compare value. CIN\_CTL\_WRITE\_SLEEP before releasing the mutex to add flow control to the cin.

**Returns**

Returns 0 on success non-zero if error



## 5.3 Cin Power Routines

### Functions

- int `cin_ctl_pwr` (`cin_ctl_t` \*cin, int pwr)
- int `cin_ctl_fp_pwr` (`cin_ctl_t` \*cin, int pwr)
- int `cin_ctl_fo_test_pattern` (`cin_ctl_t` \*cin, int on\_off)

#### 5.3.1 Detailed Description

These routine control power to the CIN for the Frame FPGA and the Front Panel

#### 5.3.2 Function Documentation

##### 5.3.2.1 `cin_ctl_fo_test_pattern()`

```
int cin_ctl_fo_test_pattern (
    cin_ctl_t * cin,
    int on_off )
```

Control Fiber Optic Interface Test Pattern

Turn on and off the fiber optic test pattern. The FO modules transmit a test pattern to indicate that communication with the data modules is correct. This routine turns on and off the modules. If on\_off is 0 then the FO test pattern is turned off, and if on\_off is 1 then the FO test pattern is turned on. Note: this routine manipulates the fCRIC mask, so you may need to reconfigure the fCRICs after using it.

cin handle to cin library on\_off test pattern status

CIN\_OK on success, CIN\_ERROR on an error

##### 5.3.2.2 `cin_ctl_fp_pwr()`

```
int cin_ctl_fp_pwr (
    cin_ctl_t * cin,
    int pwr )
```

Control CIN Front Panel Power

Turn on and off the CIN Front Panel power. The front panel power powers either the fiber optic modules or the LVDS lines to the camera. If pwr is 0 then turn off FP power and if pwr is 1 turn on the FP power.

cin handle to cin library pwr power status

CIN\_OK on success, CIN\_ERROR on an error

##### 5.3.2.3 `cin_ctl_pwr()`

```
int cin_ctl_pwr (
    cin_ctl_t * cin,
    int pwr )
```

Control CIN Frame FPGA Power

Turn on and off the frame FPGA power. If pwr is 0 then turn off power. If pwr is 1 turn on power.

cin handle to cin library pwr power status

CIN\_OK on success, CIN\_ERROR on an error

## 5.4 CIN Firmware Upload Routines

### Functions

- int [cin\\_ctl\\_load\\_firmware](#) ([cin\\_ctl\\_t](#) \*cin)
- int [cin\\_ctl\\_load\\_firmware\\_file](#) ([cin\\_ctl\\_t](#) \*cin, char \*filename)
- int [cin\\_ctl\\_load\\_firmware\\_data](#) ([cin\\_ctl\\_t](#) \*cin, unsigned char \*data, int data\_len)
- int [cin\\_ctl\\_load\\_config](#) ([cin\\_ctl\\_t](#) \*cin, const char \*filename)

### 5.4.1 Detailed Description

These routines control the upload of firmware to the frame FPGA in the CIN. The firmware can be uploaded using either a external file or an array of unsigned char (bytes). The function [cin\\_ctl\\_load\\_firmware\(\)](#) loads the pre-compiled firmware.

### 5.4.2 Function Documentation

#### 5.4.2.1 [cin\\_ctl\\_load\\_config\(\)](#)

```
int cin_ctl_load_config (  
    cin\_ctl\_t * cin,  
    const char * filename )
```

Load FPGA config file

Upload a FPGA config file to the CIN. This file is a simple file with each line containing a 4 digit hex value for the register location and a 4 digit hex value for the value to be written to the register.

cin handle to the cin library filename filename to load

CIN\_OK on success, CIN\_ERROR on an error

#### 5.4.2.2 [cin\\_ctl\\_load\\_firmware\(\)](#)

```
int cin_ctl_load_firmware (  
    cin\_ctl\_t * cin )
```

Load the pre-compiled frame FPGA firmware

cin handle to cin library

CIN\_OK on success, CIN\_ERROR on an error

#### 5.4.2.3 cin\_ctl\_load\_firmware\_data()

```
int cin_ctl_load_firmware_data (
    cin_ctl_t * cin,
    unsigned char * data,
    int data_len )
```

Load the frame FPGA firmware from char array

cin handle to cin library data array of binary FPGA firmware data\_len length of binary data

CIN\_OK on success, CIN\_ERROR on an error

#### 5.4.2.4 cin\_ctl\_load\_firmware\_file()

```
int cin_ctl_load_firmware_file (
    cin_ctl_t * cin,
    char * filename )
```

Load the frame FPGA firmware from file

cin handle to cin library filename file containing the binary FPGA firmware

CIN\_OK on success, CIN\_ERROR on an error

## 5.5 CIN FCLK Configuration Routines

### Functions

- int `cin_ctl_get_fclk` (`cin_ctl_t` \*cin, int \*clkfreq)
- int `cin_ctl_set_fclk` (`cin_ctl_t` \*cin, int clkfreq)

### 5.5.1 Detailed Description

These routines configure the Internal Frame FPGA Clock (FCLK) frequency.

### 5.5.2 Function Documentation

#### 5.5.2.1 `cin_ctl_get_fclk()`

```
int cin_ctl_get_fclk (  
    cin_ctl_t * cin,  
    int * clkfreq )
```

Get the current frame FPGA clock frequency

cin handle to cin library clkfreq clock frequency

CIN\_OK on success, CIN\_ERROR on an error

#### 5.5.2.2 `cin_ctl_set_fclk()`

```
int cin_ctl_set_fclk (  
    cin_ctl_t * cin,  
    int clkfreq )
```

Set the frame FPGA clock frequency

cin handle to cin library clkfreq clock frequency to set

CIN\_OK on success, CIN\_ERROR on an error

## 5.6 CIN Status Routines

### Functions

- int `cin_ctl_get_id` (`cin_ctl_t` \*cin, `cin_ctl_id_t` \*val)
- int `cin_ctl_get_cfg_fpga_status` (`cin_ctl_t` \*cin, `uint16_t` \* \_val)
- int `cin_ctl_get_dcm_status` (`cin_ctl_t` \*cin, `uint16_t` \* \_val)
- int `cin_ctl_get_power_status` (`cin_ctl_t` \*cin, int full, int \*pwr, `cin_ctl_pwr_mon_t` \*values)

### 5.6.1 Detailed Description

Group of routines to get the status of the frame and config FPGAs in the CIN.

### 5.6.2 Function Documentation

#### 5.6.2.1 `cin_ctl_get_cfg_fpga_status()`

```
int cin_ctl_get_cfg_fpga_status (
    cin_ctl_t * cin,
    uint16_t * _val )
```

`cin_val`

#### 5.6.2.2 `cin_ctl_get_id()`

```
int cin_ctl_get_id (
    cin_ctl_t * cin,
    cin_ctl_id_t * val )
```

Get the serial and firmware numbers from the CIN

cin handle to cin library id data structure containing firmware and serial numbers

CIN\_OK on success, CIN\_ERROR on an error

## 5.7 CIN Control Bias Routines

### Functions

- int **cin\_ctl\_set\_bias** ([cin\\_ctl\\_t](#) \*cin, int val)
- int **cin\_ctl\_get\_bias** ([cin\\_ctl\\_t](#) \*cin, int \*val)
- int **cin\_ctl\_set\_bias\_regs** ([cin\\_ctl\\_t](#) \*cin, uint16\_t \*vals, int verify)
- int **cin\_ctl\_get\_bias\_regs** ([cin\\_ctl\\_t](#) \*cin, uint16\_t \*vals)
- int **cin\_ctl\_set\_bias\_voltages** ([cin\\_ctl\\_t](#) \*cin, float \*voltage, int verify)
- int **cin\_ctl\_get\_bias\_voltages** ([cin\\_ctl\\_t](#) \*cin, float \*voltage, uint16\_t \*regs)

### 5.7.1 Detailed Description

Initialization group

## 5.8 CIN Control Timing Routines

### Functions

- int `cin_ctl_set_timing_regs` (`cin_ctl_t` \*cin, uint16\_t \*vals, int vals\_len)
- int `cin_ctl_get_timing_regs` (`cin_ctl_t` \*cin, uint16\_t \*vals, int vals\_len)
- int `cin_config_read_file` (`cin_ctl_t` \*cin, const char \*file)
- int `cin_config_get_timing_name` (`cin_ctl_t` \*cin, int num, char \*\*name)
- int `cin_config_get_current_timing_name` (`cin_ctl_t` \*cin, char \*\*name)

### 5.8.1 Detailed Description

Timing setup group

### 5.8.2 Function Documentation

#### 5.8.2.1 `cin_config_get_current_timing_name()`

```
int cin_config_get_current_timing_name (  
    cin_ctl_t * cin,  
    char ** name )
```

Get the name of the current timing mode

cin handle to cin library name char array of name

CIN\_OK on success, CIN\_ERROR on an error

#### 5.8.2.2 `cin_config_get_timing_name()`

```
int cin_config_get_timing_name (  
    cin_ctl_t * cin,  
    int num,  
    char ** name )
```

Get the name of the timing config options

cin handle to cin library num number of timing option name char array of name

CIN\_OK on success, CIN\_ERROR on an error

## 5.9 CIN Data Initialization Routines

### Functions

- int `cin_data_init` (`cin_data_t` \*cin, char \*addr, uint16\_t port, char \*bind\_addr, uint16\_t bind\_port, int rcvbuf, int packet\_buffer\_len, int frame\_buffer\_len, cin\_data\_callback push\_callback, cin\_data\_callback pop\_callback, void \*usr\_ptr)
- void `cin_data_destroy` (`cin_data_t` \*cin)

### 5.9.1 Detailed Description

Initialization group

### 5.9.2 Function Documentation

#### 5.9.2.1 `cin_data_destroy()`

```
void cin_data_destroy (
    cin_data_t * cin )
```

Close the cin data library and cleanup

Stop all the processing threads and join them to the main thread. This function blocks until all threads have joined the main thread (program). This should be called to clean up the library before the program is exited

#### Parameters

<i>cin</i>	Handle to cin data library
------------	----------------------------

#### 5.9.2.2 `cin_data_init()`

```
int cin_data_init (
    cin_data_t * cin,
    char * addr,
    uint16_t port,
    char * bind_addr,
    uint16_t bind_port,
    int rcvbuf,
    int packet_buffer_len,
    int frame_buffer_len,
    cin_data_callback push_callback,
    cin_data_callback pop_callback,
    void * usr_ptr )
```



Initialize the cin data library

Initialize the data handling routines and start the threads for listening.

**Parameters**

<i>cin</i>	Handle to cin data library
<i>addr</i>	IP-Address of cin (if NULL defaults to standard)
<i>port</i>	UDP Port of CIN
<i>bind_addr</i>	IP-Address to bind to (if NULL binds to 0.0.0.0)
<i>bind_port</i>	UDP Port of host
<i>rcvbuf</i>	TCP/IP Kernel receive buffer size
<i>packet_buffer_len</i>	Length of packet buffer fifo (in units number of packets)
<i>frame_buffer_len</i>	Length of frame (assembler) buffer fifo (in units of number of frames)
<i>push_callback</i>	This function is called when a data structure is needed
<i>pop_callback</i>	This function is called when an image has been processed
<i>usr_ptr</i>	Pointer passed to callback functions

## 5.10 CIN Data Framestore Functions

### Functions

- void `cin_data_framestore_trigger` (`cin_data_t` \*cin, int count)
- void `cin_data_framestore_skip` (`cin_data_t` \*cin, int count)
- int `cin_data_get_framestore_counter` (`cin_data_t` \*cin)
- void `cin_data_framestore_disable` (`cin_data_t` \*cin)
- void `cin_data_framestore_trigger_enable` (`cin_data_t` \*cin)

### 5.10.1 Detailed Description

Framestore Group

### 5.10.2 Function Documentation

#### 5.10.2.1 `cin_data_framestore_disable()`

```
void cin_data_framestore_disable (  
    cin_data_t * cin )
```

Disable the framestore modes

This function disables the framestore modes (software trigger and skip). If the camera is hardware triggering then the images will start to be processed.

#### Parameters

<code>cin</code>	Handle to the cin library
------------------	---------------------------

#### 5.10.2.2 `cin_data_framestore_skip()`

```
void cin_data_framestore_skip (  
    cin_data_t * cin,  
    int count )
```

Enable framestore skip mode

Enable the framestore skip mode. This function should be called before hardware triggering the camera. This causes the data processing to skip

## Parameters

<i>count</i>	frames from the first images to be read. This is usually done to stop the first few frames from being over exposed.
<i>cin</i>	handle to the <a href="#">cin_data</a> library

5.10.2.3 `cin_data_framestore_trigger()`

```
void cin_data_framestore_trigger (
    cin_data_t * cin,
    int count )
```

Send a framestore (software) trigger

Send a software trigger to the CIN by timestamping the request time and allow images to be processed when recieved after this time. The count option sets the number of frames to trigger. A value of -1 indicated that the trigger should not count images but run indefinitely after the trigger has occurred.

## Parameters

<i>cin</i>	handle to the <a href="#">cin_data</a> library
<i>count</i>	number of frames to trigger

5.10.2.4 `cin_data_framestore_trigger_enable()`

```
void cin_data_framestore_trigger_enable (
    cin_data_t * cin )
```

Enable the framestore trigger mode

This function enables the framestore trigger mode. It cases the images to not be processed pending a call to the function to (software) trigger the camera.

## Parameters

<i>cin</i>	Handle to the cin library
------------	---------------------------

5.10.2.5 `cin_data_get_framestore_counter()`

```
int cin_data_get_framestore_counter (
    cin_data_t * cin )
```

Get the value of the framestore counter

Return the number of frames in the framestore counter. In trigger mode, this returns the number of frames to go. In skip mode, this returns the number of frames that have to be skipped.

#### Parameters

<i>cin</i>	handle to the <a href="#">cin_data</a> library
------------	--

#### Returns

Number of frames to go in trigger



## Chapter 6

# Class Documentation

### 6.1 cin\_config\_timing Struct Reference

#### Public Attributes

- uint16\_t \* [data](#)
- int [data\\_len](#)
- char [name](#) [[CIN\\_CONFIG\\_MAX\\_TIMING\\_NAME](#)]
- int [rows](#)
- int [cols](#)
- int [overscan](#)
- int [fclk\\_freq](#)
- int [framestore](#)

#### 6.1.1 Member Data Documentation

##### 6.1.1.1 cols

```
int cin_config_timing::cols
```

Cols for this timing setup

##### 6.1.1.2 data

```
uint16_t* cin_config_timing::data
```

Pointer to timing data

##### 6.1.1.3 data\_len

```
int cin_config_timing::data_len
```

timing data length

#### 6.1.1.4 fclk\_freq

```
int cin_config_timing::fclk_freq
```

FCLK Frequency to use

#### 6.1.1.5 framestore

```
int cin_config_timing::framestore
```

Flag (not zero means framestore

#### 6.1.1.6 name

```
char cin_config_timing::name[CIN_CONFIG_MAX_TIMING_NAME]
```

String for config name

#### 6.1.1.7 overscan

```
int cin_config_timing::overscan
```

Number of overscan cols for this setup

#### 6.1.1.8 rows

```
int cin_config_timing::rows
```

Rows for this timing setup

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.2 cin\_ctl Struct Reference

### Public Attributes

- char \* **addr**
- char \* **bind\_addr**
- int **port**
- int **bind\_port**
- int **sport**
- int **bind\_sport**
- [cin\\_port\\_t](#) **ctl\_port**
- [cin\\_port\\_t](#) **stream\_port**
- [cin\\_config\\_timing\\_t](#) **timing** [[CIN\\_CONFIG\\_MAX\\_TIMING\\_MODES](#)]
- int **timing\_num**
- [cin\\_config\\_timing\\_t](#) \* **current\_timing**
- float **fclk\_time\_factor**
- [cin\\_ctl\\_listener\\_t](#) \* **listener**
- pthread\_mutex\_t **access**
- pthread\_mutexattr\_t **access\_attr**
- void(\* **msg\_callback**)(const char \*, int, void \*)
- void \* **msg\_callback\_ptr**



## 6.2.1 Member Data Documentation

### 6.2.1.1 fclk\_time\_factor

```
float cin_ctl::fclk_time_factor
```

In micro seconds

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.3 cin\_ctl\_id Struct Reference

### Public Attributes

- uint16\_t **base\_board\_id**
- uint16\_t **base\_serial\_no**
- uint16\_t **base\_fpga\_ver**
- uint16\_t **fabric\_board\_id**
- uint16\_t **fabric\_serial\_no**
- uint16\_t **fabric\_fpga\_ver**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.4 cin\_ctl\_listener Struct Reference

### Public Attributes

- struct [cin\\_port](#) \* **cp**
- [fifo](#) **ctl\_fifo**
- pthread\_t **thread\_id**
- pthread\_barrier\_t **barrier**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.5 cin\_ctl\_pwr\_mon\_t Struct Reference

### Public Attributes

- [cin\\_ctl\\_pwr\\_val\\_t](#) **bus\_12v0**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **mgmt\_3v3**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **mgmt\_2v5**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **mgmt\_1v2**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **enet\_1v0**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **s3e\_3v3**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **gen\_3v3**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **gen\_2v5**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **v6\_0v9**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **v6\_1v0**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **v6\_2v5**
- [cin\\_ctl\\_pwr\\_val\\_t](#) **fp**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.6 cin\_ctl\_pwr\_val Struct Reference

### Public Attributes

- double **i**
- double **v**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.7 cin\_data Struct Reference

### Public Attributes

- [fifo](#) \* **packet\_fifo**
- [fifo](#) \* **frame\_fifo**
- [cin\\_data\\_threads\\_t](#) **listen\_thread**
- [cin\\_data\\_threads\\_t](#) **assembler\_thread**
- [cin\\_data\\_threads\\_t](#) **descramble\_thread**
- [pthread\\_mutex\\_t](#) **descramble\_mutex**
- [pthread\\_mutex\\_t](#) **stats\_mutex**
- [pthread\\_mutex\\_t](#) **framestore\_mutex**
- [cin\\_data\\_callbacks\\_t](#) **callbacks**
- char \* **addr**
- char \* **bind\_addr**
- int **port**

- int **bind\_port**
- int **recv\_buf**
- [cin\\_port\\_t](#) **dp**
- struct timespec **framerate**
- unsigned long int **dropped\_packets**
- unsigned long int **malformed\_packets**
- uint16\_t **last\_frame**
- [cin\\_data\\_descramble\\_map\\_t](#) **map**
- int **framestore\_mode**
- struct timespec **framestore\_trigger**
- int **framestore\_counter**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.8 cin\_data\_callbacks Struct Reference

### Public Attributes

- void **push** ([cin\\_data\\_frame\\_t](#) \*, void \*usr\_ptr)
- void **pop** ([cin\\_data\\_frame\\_t](#) \*, void \*usr\_ptr)
- [cin\\_data\\_frame\\_t](#) \* **frame**
- void \* **usr\_ptr**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.9 cin\_data\_descramble\_map\_t Struct Reference

### Public Attributes

- uint32\_t \* **map**
- int **size\_x**
- int **size\_y**
- int **overscan**
- int **rows**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.10 cin\_data\_frame Struct Reference

### Public Attributes

- uint16\_t \* **data**
- uint16\_t **number**
- struct timespec **timestamp**
- int **size\_x**
- int **size\_y**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.11 cin\_data\_packet Struct Reference

### Public Attributes

- unsigned char \* **data**
- int **size**
- struct timespec **timestamp**

The documentation for this struct was generated from the following file:

- [src/data.h](#)

## 6.12 cin\_data\_proc Struct Reference

### Public Attributes

- void \*(\* **input\_get** )(void \*, int)
- void \*(\* **input\_put** )(void \*, int)
- void \* **input\_args**
- int **reader**
- void \*(\* **output\_put** )(void \*)
- void \*(\* **output\_get** )(void \*)
- void \* **output\_args**
- [cin\\_data\\_t](#) \* **parent**

The documentation for this struct was generated from the following file:

- [src/data.h](#)

## 6.13 cin\_data\_stats Struct Reference

### Public Attributes

- int **last\_frame**
- double **framerate**
- double **packet\_percent\_full**
- double **frame\_percent\_full**
- double **image\_percent\_full**
- long int **packet\_overruns**
- long int **frame\_overruns**
- long int **image\_overruns**
- long int **packet\_used**
- long int **frame\_used**
- long int **image\_used**
- long int **dropped\_packets**
- long int **mallformed\_packets**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.14 cin\_data\_threads Struct Reference

### Public Attributes

- pthread\_t **thread\_id**
- pthread\_barrier\_t **barrier**
- int **started**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

## 6.15 cin\_map\_t Struct Reference

### Public Attributes

- char \* **name**
- uint16\_t **reg**

The documentation for this struct was generated from the following file:

- [src/cinregisters.h](#)

## 6.16 cin\_port Struct Reference

### Public Attributes

- int **sockfd**
- struct timeval **tv**
- struct sockaddr\_in **sin\_srv**
- struct sockaddr\_in **sin\_cli**
- socklen\_t **slen**

The documentation for this struct was generated from the following file:

- src/[cin.h](#)

## 6.17 cin\_timing\_state Struct Reference

```
#include <cin.h>
```

### Public Attributes

- uint8\_t [passes\\_per\\_state](#)
- uint8\_t [next\\_state](#)
- uint32\_t [loop\\_back\\_counter](#)
- uint8\_t [loop\\_state](#)
- uint8\_t [total\\_ticks](#)
- uint8\_t [initial\\_state](#) [15]
- uint8\_t [edge1](#) [15]
- uint8\_t [edge2](#) [15]
- uint8\_t **spare1**
- uint8\_t **spare2**

### 6.17.1 Detailed Description

CIN CCD Timing state

Each timing state is made up of 52 parameters

0 passes\_per\_state 1 next\_state 3 loop\_backs\_for\_state When not zero go to loop\_state and subtract 1 4 loop\_state 5 ccd\_clock\_cnt\_end Number of clock counts for 1 pass of this state 6 -20 initial\_clock\_value[15] There are 8 vertical, 4 horizontal, convert, save\_data and spare 21-35 clock\_edge1[15] After this number of ticks the clock signal is inverted from initial\_clock\_value 36-50 clock\_edge2[15] After this number of ticks the clock signal is reverted to

### 6.17.2 Member Data Documentation

#### 6.17.2.1 edge1

```
uint8_t cin_timing_state::edge1[15]
```

Number of ticks to wait before inverting clock state

#### 6.17.2.2 edge2

```
uint8_t cin_timing_state::edge2[15]
```

Number of ticks to wait before returning to initial\_state

#### 6.17.2.3 initial\_state

```
uint8_t cin_timing_state::initial_state[15]
```

Initial clock values

#### 6.17.2.4 loop\_back\_counter

```
uint32_t cin_timing_state::loop_back_counter
```

Number of jumps to loop\_state

#### 6.17.2.5 loop\_state

```
uint8_t cin_timing_state::loop_state
```

State to jump to when loop\_state is non zero

#### 6.17.2.6 next\_state

```
uint8_t cin_timing_state::next_state
```

State to jump to upon completion

#### 6.17.2.7 passes\_per\_state

```
uint8_t cin_timing_state::passes_per_state
```

Number of times to pass through this state

#### 6.17.2.8 total\_ticks

```
uint8_t cin_timing_state::total_ticks
```

Total number of ticks for this state

The documentation for this struct was generated from the following file:

- [src/cin.h](#)

### 6.18 fifo Struct Reference

#### Public Attributes

- void \* **data**
- void \* **head**
- void \* **tail**
- void \* **end**
- long int **size**
- int **elem\_size**
- int **full**
- long int **overruns**
- pthread\_mutex\_t **mutex**
- pthread\_cond\_t **signal**

The documentation for this struct was generated from the following file:

- [src/cin.h](#)



## Chapter 7

# File Documentation

### 7.1 src/cin.h File Reference

```
#include <stdint.h>
#include <stdio.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <netinet/ip.h>
#include <sys/time.h>
#include <pthread.h>
```

#### Classes

- struct [fifo](#)
- struct [cin\\_ctl\\_listener](#)
- struct [cin\\_port](#)
- struct [cin\\_timing\\_state](#)
- struct [cin\\_config\\_timing](#)
- struct [cin\\_ctl](#)
- struct [cin\\_data\\_frame](#)
- struct [cin\\_data\\_stats](#)
- struct [cin\\_data\\_threads](#)
- struct [cin\\_data\\_callbacks](#)
- struct [cin\\_data\\_descramble\\_map\\_t](#)
- struct [cin\\_data](#)
- struct [cin\\_ctl\\_id](#)
- struct [cin\\_ctl\\_pwr\\_val](#)
- struct [cin\\_ctl\\_pwr\\_mon\\_t](#)

## Macros

- `#define CIN_OK 0`
- `#define CIN_ERROR -1`
- `#define CIN_CTL_MSG_OK 0`
- `#define CIN_CTL_MSG_MINOR 1`
- `#define CIN_CTL_MSG_MAJOR 2`
- `#define CIN_CTL_IP "192.168.1.207"`
- `#define CIN_CTL_CIN_PORT 49200`
- `#define CIN_CTL_BIND_PORT 50200`
- `#define CIN_CTL_FRMW_CIN_PORT 49202`
- `#define CIN_CTL_FRMW_BIND_PORT 50202`
- `#define CIN_CTL_RCVBUF 10`
- `#define CIN_CTL_MAX_READ_TRIES 5`
- `#define CIN_CTL_MAX_WRITE_TRIES 5`
- `#define CIN_CTL_WRITE_SLEEP 100`
- `#define CIN_CTL_READ_SLEEP 100`
- `#define CIN_CTL_BIAS_SLEEP 100000`
- `#define CIN_CTL_FO_SLEEP 500000`
- `#define CIN_CTL_CONFIG_SLEEP 100`
- `#define CIN_CTL_DCO_SLEEP 1000000`
- `#define CIN_CTL_FCLK_SLEEP 200000`
- `#define CIN_CTL_STREAM_CHUNK 512`
- `#define CIN_CTL_STREAM_SLEEP 5`
- `#define CIN_CTL_PACKET_WAIT 1000`
- `#define CIN_CTL_PACKET_LOOPS 250`
- `#define CIN_CTL_POWER_ENABLE 0x001F`
- `#define CIN_CTL_POWER_DISABLE 0x0000`
- `#define CIN_CTL_FP_POWER_ENABLE 0x0020`
- `#define CIN_CTL_DCM_LOCKED 0x0001`
- `#define CIN_CTL_DCM_PSDONE 0x0002`
- `#define CIN_CTL_DCM_STATUS0 0x0004`
- `#define CIN_CTL_DCM_STATUS1 0x0008`
- `#define CIN_CTL_DCM_STATUS2 0x0010`
- `#define CIN_CTL_DCM_TX1_READY 0x0020`
- `#define CIN_CTL_DCM_TX2_READY 0x0040`
- `#define CIN_CTL_DCM_ATCA_ALARM 0x0080`
- `#define CIN_CTL_TRIG_INTERNAL 0x0000`
- `#define CIN_CTL_TRIG_EXTERNAL_1 0x0001`
- `#define CIN_CTL_TRIG_EXTERNAL_2 0x0002`
- `#define CIN_CTL_TRIG_EXTERNAL_BOTH 0x0003`
- `#define CIN_CTL_FOCUS_BIT 0x0002`
- `#define CIN_CTL_FCLK_125 0x0000`
- `#define CIN_CTL_FCLK_200 0x0001`
- `#define CIN_CTL_FCLK_250 0x0002`
- `#define CIN_CTL_FCLK_125_C 0x0003`
- `#define CIN_CTL_FCLK_200_C 0x0004`
- `#define CIN_CTL_FCLK_250_C 0x0005`
- `#define CIN_CTL_FCLK_156_C 0x0006`
- `#define CIN_CTL_FPGA_STS_CFG 0x8000`
- `#define CIN_CTL_FPGA_STS_FP_PWR 0x0008`
- `#define CIN_CTL_DCM_STS_ATCA 0x0080`
- `#define CIN_CTL_DCM_STS_LOCKED 0x0001`
- `#define CIN_CTL_DCM_STS_OVERRIDE 0x0800`
- `#define CIN_CTL_MUX1_VCLK1 0x0001`

- #define **CIN\_CTL\_MUX1\_VCLK2** 0x0002
- #define **CIN\_CTL\_MUX1\_VCLK3** 0x0003
- #define **CIN\_CTL\_MUX1\_ATG** 0x0004
- #define **CIN\_CTL\_MUX1\_VFCLK1** 0x0005
- #define **CIN\_CTL\_MUX1\_VFCLK2** 0x0006
- #define **CIN\_CTL\_MUX1\_VFCLK3** 0x0007
- #define **CIN\_CTL\_MUX1\_HCLK1** 0x0008
- #define **CIN\_CTL\_MUX1\_HCLK2** 0x0009
- #define **CIN\_CTL\_MUX1\_OSW** 0x000A
- #define **CIN\_CTL\_MUX1\_RST** 0x000B
- #define **CIN\_CTL\_MUX1\_CONVERT** 0x000C
- #define **CIN\_CTL\_MUX1\_SHUTTER** 0x000D
- #define **CIN\_CTL\_MUX1\_SWTRIGGER** 0x000E
- #define **CIN\_CTL\_MUX1\_TRIGMON** 0x000F
- #define **CIN\_CTL\_MUX1\_EXPOSE** 0x0000
- #define **CIN\_CTL\_MUX2\_VCLK1** 0x0010
- #define **CIN\_CTL\_MUX2\_VCLK2** 0x0020
- #define **CIN\_CTL\_MUX2\_VCLK3** 0x0030
- #define **CIN\_CTL\_MUX2\_ATG** 0x0040
- #define **CIN\_CTL\_MUX2\_VFCLK1** 0x0050
- #define **CIN\_CTL\_MUX2\_VFCLK2** 0x0060
- #define **CIN\_CTL\_MUX2\_VFCLK3** 0x0070
- #define **CIN\_CTL\_MUX2\_HCLK1** 0x0080
- #define **CIN\_CTL\_MUX2\_HCLK2** 0x0090
- #define **CIN\_CTL\_MUX2\_HCLK3** 0x00A0
- #define **CIN\_CTL\_MUX2\_OSW** 0x00B0
- #define **CIN\_CTL\_MUX2\_RST** 0x00C0
- #define **CIN\_CTL\_MUX2\_CONVERT** 0x00D0
- #define **CIN\_CTL\_MUX2\_SAVE** 0x00E0
- #define **CIN\_CTL\_MUX2\_HWTRIG** 0x00F0
- #define **CIN\_CTL\_MUX2\_EXPOSE** 0x0000
- #define **CIN\_CTL\_FO\_REG1** 0x821D
- #define **CIN\_CTL\_FO\_REG2** 0x821E
- #define **CIN\_CTL\_FO\_REG3** 0x821F
- #define **CIN\_DATA\_IP** "10.0.5.207"
- #define **CIN\_DATA\_BIND\_PORT** 49201
- #define **CIN\_DATA\_CIN\_PORT** 49203
- #define **CIN\_DATA\_FRAME\_BUFFER\_LEN** 1000
- #define **CIN\_DATA\_PACKET\_BUFFER\_LEN** 10000
- #define **CIN\_DATA\_MAX\_MTU** 9000
- #define **CIN\_DATA\_UDP\_HEADER** 8
- #define **CIN\_DATA\_MAGIC\_PACKET** UINT64\_C(0x0000F4F3F2F1F000)
- #define **CIN\_DATA\_MAGIC\_PACKET\_MASK** UINT64\_C(0x0000FFFFFFFFFFFF00)
- #define **CIN\_DATA\_TAIL\_MAGIC\_PACKET** UINT64\_C(0x010DF0ADDEF2F1F0)
- #define **CIN\_DATA\_TAIL\_MAGIC\_PACKET\_MASK** UINT64\_C(0xFFFFFFFFFFFFFFFF)
- #define **CIN\_DATA\_DROPPED\_PACKET\_VAL** 0x2000
- #define **CIN\_DATA\_DATA\_MASK** 0x1FFF
- #define **CIN\_DATA\_CTRL\_MASK** 0xE000
- #define **CIN\_DATA\_SIGN\_MASK** 0x1000
- #define **CIN\_DATA\_GAIN\_8** 0xC000
- #define **CIN\_DATA\_GAIN\_4** 0x4000
- #define **CIN\_DATA\_PACKET\_LEN** 8184
- #define **CIN\_DATA\_MAX\_PACKETS** 542
- #define **CIN\_DATA\_RCVBUF** (100\*1024\*1024)
- #define **CIN\_DATA\_MAX\_FRAME\_X** 1152

- `#define CIN_DATA_MAX_FRAME_Y 2050`
- `#define CIN_DATA_MAX_STREAM 2400000`
- `#define CIN_DATA_CCD_COLS 96`
- `#define CIN_DATA_CCD_COLS_PER_CHAN 10`
- `#define CIN_DATA_PIPELINE_FLUSH 1344`
- `#define CIN_CTL_NUM_BIAS 20`
- `#define CIN_CTL_BIAS_OFFSET 0x0030`
- `#define CIN_CTL_BIAS_POSH 0`
- `#define CIN_CTL_BIAS_NEGH 1`
- `#define CIN_CTL_BIAS_POSRG 2`
- `#define CIN_CTL_BIAS_NEGRG 3`
- `#define CIN_CTL_BIAS_POSSW 4`
- `#define CIN_CTL_BIAS_NEGSW 5`
- `#define CIN_CTL_BIAS_POSV 6`
- `#define CIN_CTL_BIAS_NEGV 7`
- `#define CIN_CTL_BIAS_POSTG 8`
- `#define CIN_CTL_BIAS_NEGTG 9`
- `#define CIN_CTL_BIAS_POSVF 10`
- `#define CIN_CTL_BIAS_NEGVF 11`
- `#define CIN_CTL_BIAS_NEDGE 12`
- `#define CIN_CTL_BIAS_OTG 13`
- `#define CIN_CTL_BIAS_VDDR 14`
- `#define CIN_CTL_BIAS_VDD_OUT 15`
- `#define CIN_CTL_BIAS_BUF_BASE 16`
- `#define CIN_CTL_BIAS_BUF_DELTA 17`
- `#define CIN_CTL_BIAS_SPARE1 18`
- `#define CIN_CTL_BIAS_SPARE2 19`
- `#define DEBUG_PRINT(fmt, ...) if(_debug_print_flag) { fprintf(stderr, "%s:%d:%s(): " fmt, __FILE__, __LINE__, __func__, __VA_ARGS__); }`
- `#define DEBUG_COMMENT(fmt) if(_debug_print_flag) { fprintf(stderr, "%s:%d:%s(): " fmt, __FILE__, __LINE__, __func__); }`
- `#define ERROR_COMMENT(fmt) if(_error_print_flag) { fprintf(stderr, "%s:%d:%s(): " fmt, __FILE__, __LINE__, __func__); }`
- `#define ERROR_PRINT(fmt, ...) if(_error_print_flag) { fprintf(stderr, "%s:%d:%s(): " fmt, __FILE__, __LINE__, __func__, __VA_ARGS__); }`
- `#define CIN_CONFIG_MAX_STRING 40`
- `#define CIN_CONFIG_MAX_TIMING_DATA 880`
- `#define CIN_CONFIG_MAX_TIMING_MODES 10`
- `#define CIN_CONFIG_MAX_TIMING_NAME 40`

## Typedefs

- `typedef struct cin_ctl_listener cin_ctl_listener_t`
- `typedef struct cin_port cin_port_t`
- `typedef struct cin_timing_state cin_timing_state_t`
- `typedef struct cin_config_timing cin_config_timing_t`
- `typedef struct cin_ctl cin_ctl_t`
- `typedef struct cin_data_frame cin_data_frame_t`
- `typedef struct cin_data_stats cin_data_stats_t`
- `typedef struct cin_data_threads cin_data_threads_t`
- `typedef struct cin_data_callbacks cin_data_callbacks_t`
- `typedef struct cin_data cin_data_t`
- `typedef void(* cin_data_callback) (cin_data_frame_t *, void *usr_ptr)`
- `typedef void(* cin_ctl_msg_callback) (const char *, int, void *)`
- `typedef struct cin_ctl_id cin_ctl_id_t`
- `typedef struct cin_ctl_pwr_val cin_ctl_pwr_val_t`

## Functions

- void **cin\_set\_debug\_print** (int debug)
- void **cin\_set\_error\_print** (int error)
- void **cin\_report** (FILE \*fp, int details)
- int **cin\_ctl\_init** (cin\_ctl\_t \*cin, char \*addr, uint16\_t port, uint16\_t sport, char \*bind\_addr, uint16\_t bind\_port, uint16\_t bind\_sport)
- int **cin\_ctl\_destroy** (cin\_ctl\_t \*cin)
- void **cin\_ctl\_set\_msg\_callback** (cin\_ctl\_t \*cin, cin\_ctl\_msg\_callback callback, void \*ptr)
- int **cin\_data\_send\_magic** (cin\_data\_t \*cin)
- int **cin\_ctl\_read** (cin\_ctl\_t \*cin, uint16\_t reg, uint16\_t \*val)
- int **cin\_ctl\_write** (cin\_ctl\_t \*cin, uint16\_t reg, uint16\_t val, int wait)
- int **cin\_ctl\_stream\_write** (cin\_ctl\_t \*cin, unsigned char \*val, int size)
- int **cin\_ctl\_write\_with\_readback** (cin\_ctl\_t \*cin, uint16\_t reg, uint16\_t val)
- int **cin\_ctl\_pwr** (cin\_ctl\_t \*cin, int pwr)
- int **cin\_ctl\_fp\_pwr** (cin\_ctl\_t \*cin, int pwr)
- int **cin\_ctl\_fo\_test\_pattern** (cin\_ctl\_t \*cin, int on\_off)
- int **cin\_ctl\_load\_firmware** (cin\_ctl\_t \*cin)
- int **cin\_ctl\_load\_firmware\_file** (cin\_ctl\_t \*cin, char \*filename)
- int **cin\_ctl\_load\_firmware\_data** (cin\_ctl\_t \*cin, unsigned char \*data, int data\_len)
- int **cin\_ctl\_load\_config** (cin\_ctl\_t \*cin, const char \*filename)
- int **cin\_ctl\_get\_folk** (cin\_ctl\_t \*cin, int \*clkfreq)
- int **cin\_ctl\_set\_folk** (cin\_ctl\_t \*cin, int clkfreq)
- int **cin\_ctl\_get\_id** (cin\_ctl\_t \*cin, cin\_ctl\_id\_t \*val)
- int **cin\_ctl\_get\_cfg\_fpga\_status** (cin\_ctl\_t \*cin, uint16\_t \*\_val)
- int **cin\_ctl\_get\_dcm\_status** (cin\_ctl\_t \*cin, uint16\_t \*\_val)
- int **cin\_ctl\_get\_power\_status** (cin\_ctl\_t \*cin, int full, int \*pwr, cin\_ctl\_pwr\_mon\_t \*values)
- int **cin\_ctl\_set\_bias** (cin\_ctl\_t \*cin, int val)
- int **cin\_ctl\_get\_bias** (cin\_ctl\_t \*cin, int \*val)
- int **cin\_ctl\_set\_bias\_regs** (cin\_ctl\_t \*cin, uint16\_t \*vals, int verify)
- int **cin\_ctl\_get\_bias\_regs** (cin\_ctl\_t \*cin, uint16\_t \*vals)
- int **cin\_ctl\_set\_bias\_voltages** (cin\_ctl\_t \*cin, float \*voltage, int verify)
- int **cin\_ctl\_get\_bias\_voltages** (cin\_ctl\_t \*cin, float \*voltage, uint16\_t \*regs)
- int **cin\_ctl\_set\_timing\_regs** (cin\_ctl\_t \*cin, uint16\_t \*vals, int vals\_len)
- int **cin\_ctl\_get\_timing\_regs** (cin\_ctl\_t \*cin, uint16\_t \*vals, int vals\_len)
- int **cin\_ctl\_get\_camera\_pwr** (cin\_ctl\_t \*cin, int \*val)
- int **cin\_ctl\_set\_camera\_pwr** (cin\_ctl\_t \*cin, int val)
- int **cin\_ctl\_set\_clocks** (cin\_ctl\_t \*cin, int val)
- int **cin\_ctl\_get\_clocks** (cin\_ctl\_t \*cin, int \*val)
- int **cin\_ctl\_set\_trigger** (cin\_ctl\_t \*cin, int val)
- int **cin\_ctl\_get\_trigger** (cin\_ctl\_t \*cin, int \*val)
- int **cin\_ctl\_set\_focus** (cin\_ctl\_t \*cin, int val)
- int **cin\_ctl\_get\_focus** (cin\_ctl\_t \*cin, int \*val)
- int **cin\_ctl\_get\_triggering** (cin\_ctl\_t \*cin, int \*trigger)
- int **cin\_ctl\_int\_trigger\_start** (cin\_ctl\_t \*cin, int nimages)
- int **cin\_ctl\_int\_trigger\_stop** (cin\_ctl\_t \*cin)
- int **cin\_ctl\_ext\_trigger\_start** (cin\_ctl\_t \*cin, int trigger\_mode)
- int **cin\_ctl\_ext\_trigger\_stop** (cin\_ctl\_t \*cin)
- int **cin\_ctl\_set\_exposure\_time** (cin\_ctl\_t \*cin, float e\_time)
- int **cin\_ctl\_set\_trigger\_delay** (cin\_ctl\_t \*cin, float t\_time)
- int **cin\_ctl\_set\_cycle\_time** (cin\_ctl\_t \*cin, float ftime)
- int **cin\_ctl\_frame\_count\_reset** (cin\_ctl\_t \*cin)
- int **cin\_ctl\_set\_mux** (cin\_ctl\_t \*cin, int setting)
- int **cin\_ctl\_get\_mux** (cin\_ctl\_t \*cin, int \*setting)
- int **cin\_ctl\_set\_fcric\_clamp** (cin\_ctl\_t \*cin, int clamp)

- int **cin\_ctl\_set\_fcric\_gain** ([cin\\_ctl\\_t](#) \*cin, int gain)
- int **cin\_ctl\_set\_fcric\_regs** ([cin\\_ctl\\_t](#) \*cin, uint16\_t \*reg, int num\_reg)
- int **cin\_ctl\_set\_fcric** ([cin\\_ctl\\_t](#) \*cin)
- int **cin\_ctl\_set\_fabric\_address** ([cin\\_ctl\\_t](#) \*cin, char \*ip)
- int **cin\_ctl\_bias\_dump** ([cin\\_ctl\\_t](#) \*cin, FILE \*fp)
- int **cin\_ctl\_reg\_dump** ([cin\\_ctl\\_t](#) \*cin, FILE \*fp)
- int **cin\_config\_read\_file** ([cin\\_ctl\\_t](#) \*cin, const char \*file)
- int **cin\_config\_get\_timing\_name** ([cin\\_ctl\\_t](#) \*cin, int num, char \*\*name)
- int **cin\_config\_get\_current\_timing\_name** ([cin\\_ctl\\_t](#) \*cin, char \*\*name)
- void **cin\_ctl\_message** ([cin\\_ctl\\_t](#) \*cin, const char \*message, int severity)
- int **cin\_data\_init** ([cin\\_data\\_t](#) \*cin, char \*addr, uint16\_t port, char \*bind\_addr, uint16\_t bind\_port, int rcvbuf, int packet\_buffer\_len, int frame\_buffer\_len, cin\_data\_callback push\_callback, cin\_data\_callback pop\_callback, void \*usr\_ptr)
- void **cin\_data\_destroy** ([cin\\_data\\_t](#) \*cin)
- void **cin\_data\_framestore\_trigger** ([cin\\_data\\_t](#) \*cin, int count)
- void **cin\_data\_framestore\_skip** ([cin\\_data\\_t](#) \*cin, int count)
- int **cin\_data\_get\_framestore\_counter** ([cin\\_data\\_t](#) \*cin)
- void **cin\_data\_framestore\_disable** ([cin\\_data\\_t](#) \*cin)
- void **cin\_data\_framestore\_trigger\_enable** ([cin\\_data\\_t](#) \*cin)
- struct [cin\\_data\\_frame](#) \* **cin\_data\_get\_next\_frame** ([cin\\_data\\_t](#) \*cin)
- void **cin\_data\_release\_frame** ([cin\\_data\\_t](#) \*cin, int free\_mem)
- struct [cin\\_data\\_frame](#) \* **cin\_data\_get\_buffered\_frame** (void)
- void **cin\_data\_release\_buffered\_frame** (void)
- void **cin\_data\_compute\_stats** ([cin\\_data\\_t](#) \*cin, [cin\\_data\\_stats\\_t](#) \*stats)
- void **cin\_data\_show\_stats** (FILE \*fp, [cin\\_data\\_stats\\_t](#) stats)
- void **cin\_data\_reset\_stats** ([cin\\_data\\_t](#) \*cin)
- int **cin\_data\_set\_descramble\_params** ([cin\\_data\\_t](#) \*cin, int rows, int overscan)
- void **cin\_data\_get\_descramble\_params** ([cin\\_data\\_t](#) \*cin, int \*rows, int \*overscan, int \*xsize, int \*ysize)
- int **cin\_com\_boot** ([cin\\_ctl\\_t](#) \*cin\_ctl, [cin\\_data\\_t](#) \*cin\_data, int mode)
- int **cin\_com\_set\_timing** ([cin\\_ctl\\_t](#) \*cin\_ctl, [cin\\_data\\_t](#) \*cin\_data, int mode)
- int **cin\_config\_find\_timing** ([cin\\_ctl\\_t](#) \*cin, const char \*name)
- int **cin\_ctl\_upload\_bias** ([cin\\_ctl\\_t](#) \*cin)

## Variables

- const char \* **cin\_build\_git\_time**
- const char \* **cin\_build\_git\_sha**
- const char \* **cin\_build\_version**
- int **\_debug\_print\_flag**
- int **\_error\_print\_flag**

### 7.1.1 Detailed Description

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## 7.1.2 LICENSE

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## 7.1.3 DESCRIPTION

Header file for CIN communications

## 7.1.4 Macro Definition Documentation

### 7.1.4.1 CIN\_CONFIG\_MAX\_TIMING\_DATA

```
#define CIN_CONFIG_MAX_TIMING_DATA 880
```

Max = 55 per state, 16 states

### 7.1.4.2 CIN\_CONFIG\_MAX\_TIMING\_MODES

```
#define CIN_CONFIG_MAX_TIMING_MODES 10
```

states max

### 7.1.4.3 CIN\_CONFIG\_MAX\_TIMING\_NAME

```
#define CIN_CONFIG_MAX_TIMING_NAME 40
```

Max characters for timing name

### 7.1.4.4 CIN\_CTL\_BIAS\_OFFSET

```
#define CIN_CTL_BIAS_OFFSET 0x0030
```

Offset in address to read bias

## 7.1.5 Typedef Documentation

### 7.1.5.1 cin\_timing\_state\_t

```
typedef struct cin_timing_state cin_timing_state_t
```

CIN CCD Timing state

Each timing state is made up of 52 parameters

0 passes\_per\_state 1 next\_state 3 loop\_backs\_for\_state When not zero go to loop\_state and subtract 1 4 loop\_state 5 ccd\_clock\_cnt\_end Number of clock counts for 1 pass of this state 6 -20 initial\_clock\_value[15] There are 8 vertical, 4 horizontal, convert, save\_data and spare 21-35 clock\_edge1[15] After this number of ticks the clock signal is inverted from initial\_clock\_value 36-50 clock\_edge2[15] After this number of ticks the clock signal is reverted to

## 7.2 src/cin\_register\_map.h File Reference

### Macros

- #define REG\_COMMAND 0x0001
- #define REG\_READ\_ADDRESS 0x0002
- #define REG\_STREAM\_TYPE 0x0003
- #define CMD\_FCLK\_125 0xB000
- #define CMD\_FCLK\_200 0x7000
- #define CMD\_FCLK\_250 0x3000
- #define REG\_IF\_MAC0 0x0010
- #define REG\_IF\_MAC1 0x0011
- #define REG\_IF\_MAC2 0x0012
- #define REG\_IF\_IP0 0x0013
- #define REG\_IF\_IP1 0x0014
- #define REG\_IF\_CMD\_PORT\_NUM 0x001A
- #define REG\_IF\_STREAM\_IN\_PORT\_NUM 0x001C
- #define REG\_IF\_STREAM\_OUT\_PORT\_NUM 0x001D
- #define REG\_ETH\_RESET 0x0020
- #define REG\_ETH\_ENABLE 0x0021



- #define `REG_PHY1_MDIO_CMD` 0x0022
- #define `REG_PHY1_MDIO_CMD_DATA` 0x0023
- #define `REG_PHY1_MDIO_STATUS` 0x0024
- #define `REG_PHY1_MDIO_RD_ADDR` 0x0025
- #define `REG_PHY1_MDIO_RD_DATA` 0x0026
- #define `REG_MAC_CFG_VECTOR1` 0x0027
- #define `REG_PHY2_MDIO_CMD` 0x0028
- #define `REG_PHY2_MDIO_CMD_DATA` 0x0029
- #define `REG_PHY2_MDIO_STATUS` 0x002A
- #define `REG_PHY2_MDIO_RD_ADDR` 0x002B
- #define `REG_PHY2_MDIO_RD_DATA` 0x002C
- #define `REG_MAC_CFG_VECTOR2` 0x002D
- #define `CMD_PS_ENABLE` 0x0021
- #define `CMD_PS_POWERDOWN` 0x0022
- #define `REG_PS_ENABLE` 0x0030
- #define `REG_PS_SYNC_DIV0` 0x0031
- #define `REG_PS_SYNC_DIV1` 0x0032
- #define `REG_PS_SYNC_DIV2` 0x0033
- #define `REG_PS_SYNC_DIV3` 0x0034
- #define `REG_PS_SYNC_DIV4` 0x0035
- #define `CMD_PROGRAM_FRAME` 0x0041
- #define `REG_FRM_RESET` 0x0036
- #define `REG_FRM_10GbE_SEL` 0x0037;
- #define `CMD_ENABLE_CLKS` 0x0031
- #define `CMD_DISABLE_CLKS` 0x0032
- #define `REG_CLOCK_EN_REG` 0x0038
- #define `REG_SI570_REG0` 0x0039
- #define `REG_SI570_REG1` 0x003A
- #define `REG_SI570_REG2` 0x003B
- #define `REG_SI570_REG3` 0x003C
- #define `CMD_MON_STOP` 0x0011
- #define `CMD_MON_START` 0x0012
- #define `REG_VMON_ADC1_CH1` 0x0040 /\* V12P\_BUS Voltage Monitor \*/
- #define `REG_IMON_ADC1_CH0` 0x0041 /\* V12P\_BUS Current Monitor \*/
- #define `REG_VMON_ADC0_CH5` 0x0042 /\* V3P3\_MGMT Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH5` 0x0043 /\* V3P3\_MGMT Current Monitor \*/
- #define `REG_VMON_ADC0_CH4` 0x0044 /\* V3P3\_S3E Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH4` 0x0045 /\* V3P3\_S3E Current Monitor \*/
- #define `REG_VMON_ADC0_CH7` 0x0046 /\* V2P5\_MGMT Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH7` 0x0047 /\* V2P5\_MGMT Current Monitor \*/
- #define `REG_VMON_ADC0_CH6` 0x0048 /\* V1P8\_MGMT Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH6` 0x0049 /\* V1P8\_MGMT Current Monitor \*/
- #define `REG_VMON_ADC0_CH2` 0x004A /\* V1P2\_MGMT Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH2` 0x004B /\* V1P2\_MGMT Current Monitor \*/
- #define `REG_VMON_ADC0_CH3` 0x004C /\* V1P0\_ENET Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH3` 0x004D /\* V1P0\_ENET Current Monitor \*/
- #define `REG_VMON_ADC0_CH8` 0x004E /\* V3P3\_GEN Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH8` 0x004F /\* V3P3\_GEN Current Monitor \*/
- #define `REG_VMON_ADC0_CH9` 0x0050 /\* V2P5\_GEN Voltage Monitor \*/
- #define `REG_IMON_ADC0_CH9` 0x0051 /\* V2P5\_GEN Current Monitor \*/
- #define `REG_VMON_ADC0_CHE` 0x0052 /\* V0P9\_V6 Voltage Monitor \*/
- #define `REG_IMON_ADC0_CHE` 0x0053 /\* V0P9\_V6 Current Monitor \*/
- #define `REG_VMON_ADC0_CHD` 0x0054 /\* V2P5\_V6 Voltage Monitor \*/
- #define `REG_IMON_ADC0_CHD` 0x0055 /\* V2P5\_V6 Current Monitor \*/
- #define `REG_VMON_ADC0_CHB` 0x0056 /\* V1P0\_V6 Voltage Monitor \*/

- #define **REG\_IMON\_ADC0\_CHB** 0x0057 /\* V1P0\_V6 Current Monitor \*/
- #define **REG\_VMON\_ADC0\_CHC** 0x0058 /\* V1P2\_V6 Voltage Monitor \*/
- #define **REG\_IMON\_ADC0\_CHC** 0x0059 /\* V1P2\_V6 Current Monitor \*/
- #define **REG\_VMON\_ADC0\_CHF** 0x005A /\* V5P0\_FP Voltage Monitor (1/2) \*/
- #define **REG\_IMON\_ADC0\_CHF** 0x005B /\* V5P0\_FP Current Monitor (1/2) \*/
- #define **REG\_DCM\_STATUS** 0x0080
- #define **REG\_FPGA\_STATUS** 0x0081
- #define **REG\_BOARD\_ID** 0x008D
- #define **REG\_HW\_SERIAL\_NUM** 0x008E
- #define **REG\_FPGA\_VERSION** 0x008F
- #define **REG\_SANDBOX\_REG00** 0x00F0
- #define **REG\_SANDBOX\_REG01** 0x00F1
- #define **REG\_SANDBOX\_REG02** 0x00F2
- #define **REG\_SANDBOX\_REG03** 0x00F3
- #define **REG\_SANDBOX\_REG04** 0x00F4
- #define **REG\_SANDBOX\_REG05** 0x00F5
- #define **REG\_SANDBOX\_REG06** 0x00F6
- #define **REG\_SANDBOX\_REG07** 0x00F7
- #define **REG\_SANDBOX\_REG08** 0x00F8
- #define **REG\_SANDBOX\_REG09** 0x00F9
- #define **REG\_SANDBOX\_REG0A** 0x00FA
- #define **REG\_SANDBOX\_REG0B** 0x00FB
- #define **REG\_SANDBOX\_REG0C** 0x00FC
- #define **REG\_SANDBOX\_REG0D** 0x00FD
- #define **REG\_SANDBOX\_REG0E** 0x00FE
- #define **REG\_SANDBOX\_REG0F** 0x00FF
- #define **REG\_FRM\_COMMAND** 0x8001
- #define **REG\_FRM\_READ\_ADDRESS** 0x8002
- #define **REG\_FRM\_STREAM\_TYPE** 0x8003
- #define **CMD\_SEND\_SYNC\_PULSE** 0x0100
- #define **CMD\_SYNC\_DETECTOR2READOUT** 0x0101
- #define **CMD\_WR\_CCD\_BIAS\_REG** 0x0102
- #define **CMD\_WR\_CCD\_CLOCK\_REG** 0x0103
- #define **CMD\_SEND\_FCRIC\_CONFIG** 0x0105
- #define **CMD\_RESET\_FRAME\_COUNT** 0x0106
- #define **REG\_IF\_MAC\_FAB1B0** 0x8010
- #define **REG\_IF\_MAC\_FAB1B1** 0x8011
- #define **REG\_IF\_MAC\_FAB1B2** 0x8012
- #define **REG\_IF\_IP\_FAB1B0** 0x8013
- #define **REG\_IF\_IP\_FAB1B1** 0x8014
- #define **REG\_IF\_CMD\_PORT\_NUM\_FAB1B** 0x8015
- #define **REG\_IF\_STREAM\_IN\_PORT\_NUM\_FAB1B** 0x8016
- #define **REG\_IF\_STREAM\_OUT\_PORT\_NUM\_FAB1B** 0x8017
- #define **REG\_XAUI\_FAB1B** 0x8018
- #define **REG\_MAC\_CONFIG\_VEC\_FAB1B0** 0x8019
- #define **REG\_MAC\_CONFIG\_VEC\_FAB1B1** 0x801A
- #define **REG\_MAC\_STATS1\_FAB1B0** 0x801B
- #define **REG\_MAC\_STATS1\_FAB1B1** 0x801C
- #define **REG\_MAC\_STATS2\_FAB1B0** 0x801D
- #define **REG\_MAC\_STATS2\_FAB1B1** 0x801E
- #define **REG\_IF\_MAC\_FAB2B0** 0x8020
- #define **REG\_IF\_MAC\_FAB2B1** 0x8021
- #define **REG\_IF\_MAC\_FAB2B2** 0x8022
- #define **REG\_IF\_IP\_FAB2B0** 0x8023
- #define **REG\_IF\_IP\_FAB2B1** 0x8024

- #define **REG\_IF\_CMD\_PORT\_NUM\_FAB2B** 0x8025
- #define **REG\_IF\_STREAM\_IN\_PORT\_NUM\_FAB2B** 0x8026
- #define **REG\_IF\_STREAM\_OUT\_PORT\_NUM\_FAB2B** 0x8027
- #define **REG\_XAUI\_FAB2B** 0x8028
- #define **REG\_MAC\_CONFIG\_VEC\_FAB2B0** 0x8029
- #define **REG\_MAC\_CONFIG\_VEC\_FAB2B1** 0x802A
- #define **REG\_MAC\_STATS1\_FAB2B0** 0x802B
- #define **REG\_MAC\_STATS1\_FAB2B1** 0x802C
- #define **REG\_MAC\_STATS2\_FAB2B0** 0x802D
- #define **REG\_MAC\_STATS2\_FAB2B1** 0x802E
- #define **REG\_SRAM\_COMMAND** 0x8030
- #define **REG\_SRAM\_START\_ADDR1** 0x8031
- #define **REG\_SRAM\_START\_ADDR0** 0x8032
- #define **REG\_SRAM\_STOP\_ADDR1** 0x8033
- #define **REG\_SRAM\_STOP\_ADDR0** 0x8034
- #define **REG\_SRAM\_FRAME\_DATA\_OUT1** 0x8035
- #define **REG\_SRAM\_FRAME\_DATA\_OUT0** 0x8036
- #define **REG\_SRAM\_FRAME\_DATA\_IN1** 0x8037
- #define **REG\_SRAM\_FRAME\_DATA\_IN0** 0x8038
- #define **REG\_SRAM\_FRAME\_DV** 0x8039
- #define **REG\_SRAM\_STATUS1** 0x803A
- #define **REG\_SRAM\_STATUS0** 0x803B
- #define **CMD\_FCLK\_COMMIT** 0x0012
- #define **REG\_FCLK\_I2C\_ADDRESS** 0x8040
- #define **REG\_FCLK\_I2C\_DATA\_WR** 0x8041
- #define **REG\_FCLK\_I2C\_DATA\_RD** 0x8042
- #define **REG\_TRIGGERSELECT\_REG** 0x8050
- #define **REG\_TRIGGERMASK\_REG** 0x8051
- #define **REG\_CCDCLKSELECT\_REG** 0x8052
- #define **REG\_CDCLKDISABLE\_REG** 0x8053
- #define **REG\_FCLK\_SET0** 0xB007
- #define **REG\_FCLK\_SET1** 0xB008
- #define **REG\_FCLK\_SET2** 0xB009
- #define **REG\_FCLK\_SET3** 0xB00A
- #define **REG\_FCLK\_SET4** 0xB00B
- #define **REG\_FCLK\_SET5** 0xB00C
- #define **REG\_FRM\_DCM\_STATUS** 0x8080
- #define **REG\_FRM\_FPGA\_STATUS** 0x8081
- #define **REG\_FRM\_BOARD\_ID** 0x808D
- #define **REG\_FRM\_HW\_SERIAL\_NUM** 0x808E
- #define **REG\_FRM\_FPGA\_VERSION** 0x808F
- #define **REG\_FRM\_SANDBOX\_REG00** 0x80F0
- #define **REG\_FRM\_SANDBOX\_REG01** 0x80F1
- #define **REG\_FRM\_SANDBOX\_REG02** 0x80F2
- #define **REG\_FRM\_SANDBOX\_REG03** 0x80F3
- #define **REG\_FRM\_SANDBOX\_REG04** 0x80F4
- #define **REG\_FRM\_SANDBOX\_REG05** 0x80F5
- #define **REG\_FRM\_SANDBOX\_REG06** 0x80F6
- #define **REG\_FRM\_SANDBOX\_REG07** 0x80F7
- #define **REG\_FRM\_SANDBOX\_REG08** 0x80F8
- #define **REG\_FRM\_SANDBOX\_REG09** 0x80F9
- #define **REG\_FRM\_SANDBOX\_REG0A** 0x80FA
- #define **REG\_FRM\_SANDBOX\_REG0B** 0x80FB
- #define **REG\_FRM\_SANDBOX\_REG0C** 0x80FC
- #define **REG\_FRM\_SANDBOX\_REG0D** 0x80FD

- #define **REG\_FRM\_SANDBOX\_REG0E** 0x80FE
- #define **REG\_FRM\_SANDBOX\_REG0F** 0x80FF
- #define **REG\_DETECTOR\_REVISION\_REG** 0x8100
- #define **REG\_DETECTOR\_CONFIG\_REG1** 0x8101
- #define **REG\_DETECTOR\_CONFIG\_REG2** 0x8102
- #define **REG\_DETECTOR\_CONFIG\_REG3** 0x8103
- #define **REG\_DETECTOR\_CONFIG\_REG4** 0x8104
- #define **REG\_DETECTOR\_CONFIG\_REG5** 0x8105
- #define **REG\_DETECTOR\_CONFIG\_REG6** 0x8106
- #define **REG\_DETECTOR\_CONFIG\_REG7** 0x8107
- #define **REG\_DETECTOR\_CONFIG\_REG8** 0x8108
- #define **REG\_IMG\_PROC\_REVISION\_REG** 0x8120
- #define **REG\_IMG\_PROC\_CONFIG\_REG1** 0x8121
- #define **REG\_IMG\_PROC\_CONFIG\_REG2** 0x8122
- #define **REG\_IMG\_PROC\_CONFIG\_REG3** 0x8123
- #define **REG\_IMG\_PROC\_CONFIG\_REG4** 0x8124
- #define **REG\_IMG\_PROC\_CONFIG\_REG5** 0x8125
- #define **REG\_IMG\_PROC\_CONFIG\_REG6** 0x8126
- #define **REG\_IMG\_PROC\_CONFIG\_REG7** 0x8127
- #define **REG\_IMG\_PROC\_CONFIG\_REG8** 0x8128
- #define **REG\_BIASANDCLOCKREGISTERADDRESS** 0x8200
- #define **REG\_BIASANDCLOCKREGISTERDATA** 0x8201
- #define **REG\_CLOCKREGISTERDATAOUT** 0x8202
- #define **REG\_BIASREGISTERDATAOUT** 0x8203
- #define **REG\_BIASCONFIGREGISTER0\_REG** 0x8204
- #define **REG\_CLOCKCONFIGREGISTER0\_REG** 0x8205
- #define **REG\_BIASPARAM\_READ\_START** 0x3000
- #define **REG\_EXPOSURETIMEMSB\_REG** 0x8206
- #define **REG\_EXPOSURETIMELSB\_REG** 0x8207
- #define **REG\_ALTEXPOSURETIMEMSB\_REG** 0x8306
- #define **REG\_ALTEXPOSURETIMELSB\_REG** 0x8307
- #define **REG\_TRIGGERREPETITIONTIMEMSB\_REG** 0x8208
- #define **REG\_TRIGGERREPETITIONTIMELSB\_REG** 0x8209
- #define **REG\_DELAYTOEXPOSUREMSB\_REG** 0x820A
- #define **REG\_DELAYTOEXPOSURELSB\_REG** 0x820B
- #define **REG\_NUMBEROFEXPOSURE\_REG** 0x820C
- #define **REG\_SHUTTERTIMEMSB\_REG** 0x820D
- #define **REG\_SHUTTERTIMELSB\_REG** 0x820E
- #define **REG\_DELAYTOSHUTTERMSB\_REG** 0x820F
- #define **REG\_DELAYTOSHUTTERLSB\_REG** 0x8210
- #define **REG\_FCRIC\_MASK\_REG1** 0x8211
- #define **REG\_FCRIC\_MASK\_REG2** 0x8212
- #define **REG\_FCRIC\_MASK\_REG3** 0x8213
- #define **REG\_LVDS\_OVERFLOW\_ERROR\_REG1** 0x8214
- #define **REG\_LVDS\_OVERFLOW\_ERROR\_REG2** 0x8215
- #define **REG\_LVDS\_OVERFLOW\_ERROR\_REG3** 0x8216
- #define **REG\_LVDS\_PARITY\_ERROR\_REG1** 0x8217
- #define **REG\_LVDS\_PARITY\_ERROR\_REG2** 0x8218
- #define **REG\_LVDS\_PARITY\_ERROR\_REG3** 0x8219
- #define **REG\_LVDS\_STOP\_BIT\_ERROR\_REG1** 0x821A
- #define **REG\_LVDS\_STOP\_BIT\_ERROR\_REG2** 0x821B
- #define **REG\_LVDS\_STOP\_BIT\_ERROR\_REG3** 0x821C
- #define **REG\_FCRIC\_WRITE0\_REG** 0x821D
- #define **REG\_FCRIC\_WRITE1\_REG** 0x821E
- #define **REG\_FCRIC\_WRITE2\_REG** 0x821F

- #define **REG\_FCRIC\_READ0\_REG** 0x8220
- #define **REG\_FCRIC\_READ1\_REG** 0x8221
- #define **REG\_FCRIC\_READ2\_REG** 0x8222
- #define **REG\_DEBUGVIDEO0\_REG** 0x8223
- #define **REG\_DEBUGVIDEO1\_REG** 0x8224
- #define **REG\_DEBUGVIDEO2\_REG** 0x8225
- #define **REG\_DEBUGVIDEO3\_REG** 0x8226
- #define **REG\_DEBUGVIDEO4\_REG** 0x8227
- #define **REG\_DEBUGVIDEO5\_REG** 0x8228
- #define **REG\_DEBUGVIDEO6\_REG** 0x8229
- #define **REG\_DEBUGVIDEO7\_REG** 0x822A
- #define **REG\_DEBUGVIDEO8\_REG** 0x822B
- #define **REG\_DEBUGVIDEO9\_REG** 0x822C
- #define **REG\_DEBUGVIDEO10\_REG** 0x822D
- #define **REG\_DEBUGVIDEO11\_REG** 0x822E
- #define **REG\_DEBUGCOUNTER00\_REG** 0x822F
- #define **REG\_DEBUGCOUNTER01\_REG** 0x8230
- #define **REG\_DEBUGCOUNTER02\_REG** 0x8231
- #define **REG\_DEBUGCOUNTER03\_REG** 0x8232
- #define **REG\_DEBUGCOUNTER04\_REG** 0x8233
- #define **CMD\_READ\_REG** 0x0001

### 7.2.1 Detailed Description

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### 7.2.3 DESCRIPTION

Control and Frame FPGA Register Map

### 7.2.4 TIMING

The exposure time is set through the REG\_EXPOSURETIMEMSB\_REG and REG\_EXPOSURETIMELSB\_REG registers. Their value in wall time depends on the fclk frequency. At 200 MHz fclk a register value of 0x00000001 corresponds to 20 us. At 125 MHz, a value of 0x00000001 corresponds to 32 us.

### 7.2.5 Macro Definition Documentation

#### 7.2.5.1 CMD\_DISABLE\_CLKS

```
#define CMD_DISABLE_CLKS 0x0032
```

Disable Frame FPGA clock crystals

#### 7.2.5.2 CMD\_ENABLE\_CLKS

```
#define CMD_ENABLE_CLKS 0x0031
```

Enable selected Frame FPGA clock crystals

#### 7.2.5.3 CMD\_FCLK\_250

```
#define CMD_FCLK_250 0x3000
```

Ethernet Interface

#### 7.2.5.4 CMD\_FCLK\_COMMIT

```
#define CMD_FCLK_COMMIT 0x0012
```

Start I2C Write/Read

#### 7.2.5.5 CMD\_MON\_START

```
#define CMD_MON_START 0x0012
```

Start voltage and current monitor

#### 7.2.5.6 CMD\_MON\_STOP

```
#define CMD_MON_STOP 0x0011
```

Stop voltage and current monitor

#### 7.2.5.7 CMD\_PS\_ENABLE

```
#define CMD_PS_ENABLE 0x0021
```

Enable Selected Power Modules

#### 7.2.5.8 CMD\_PS\_POWERDOWN

```
#define CMD_PS_POWERDOWN 0x0022
```

Start power down sequence

#### 7.2.5.9 CMD\_READ\_REG

```
#define CMD_READ_REG 0x0001
```

Read Register CIN\_REGISTER\_MAP\_H

#### 7.2.5.10 CMD\_RESET\_FRAME\_COUNT

```
#define CMD_RESET_FRAME_COUNT 0x0106
```

RESET STATISTICS/DEBUG COUNTERS Ethernet Interface

#### 7.2.5.11 CMD\_SEND\_FCRIC\_CONFIG

```
#define CMD_SEND_FCRIC_CONFIG 0x0105
```

SEND CONFIG DATA TO FRIC

#### 7.2.5.12 CMD\_SEND\_SYNC\_PULSE

```
#define CMD_SEND_SYNC_PULSE 0x0100
```

ISSUES A SYNC PULSE

#### 7.2.5.13 CMD\_SYNC\_DETECTOR2READOUT

```
#define CMD_SYNC_DETECTOR2READOUT 0x0101
```

COMMAND TO SYNC DETECTOR AND READOUT (SEE IMAGE PROCESSING)

#### 7.2.5.14 CMD\_WR\_CCD\_BIAS\_REG

```
#define CMD_WR_CCD_BIAS_REG 0x0102
```

WRITE CCD BIAS REGISTERS

#### 7.2.5.15 CMD\_WR\_CCD\_CLOCK\_REG

```
#define CMD_WR_CCD_CLOCK_REG 0x0103
```

WRITE CCD CLOCK REGISTER

#### 7.2.5.16 REG\_BIASCONFIGREGISTER0\_REG

```
#define REG_BIASCONFIGREGISTER0_REG 0x8204
```

Clock Static Registers

#### 7.2.5.17 REG\_BIASREGISTERDATAOUT

```
#define REG_BIASREGISTERDATAOUT 0x8203
```

Bias Static Registers

#### 7.2.5.18 REG\_CLOCK\_EN\_REG

```
#define REG_CLOCK_EN_REG 0x0038
```

Clock Enable Register Programmable Si570 Clock Registers

#### 7.2.5.19 REG\_CLOCKCONFIGREGISTER0\_REG

```
#define REG_CLOCKCONFIGREGISTER0_REG 0x8205
```

Bias Voltage

#### 7.2.5.20 REG\_COMMAND

```
#define REG_COMMAND 0x0001
```

<Command Registers

#### 7.2.5.21 REG\_DEBUGCOUNTER04\_REG

```
#define REG_DEBUGCOUNTER04_REG 0x8233
```

=====



## CIN Commands

### Common Commands

#### 7.2.5.22 REG\_DELAYTOSHUTTERLSB\_REG

```
#define REG_DELAYTOSHUTTERLSB_REG 0x8210
```

### Digitizer Registers

#### 7.2.5.23 REG\_ETH\_ENABLE

```
#define REG_ETH_ENABLE 0x0021
```

Enable Eth Hardware 1=Rx, 2=Tx, 3=Both

#### 7.2.5.24 REG\_ETH\_RESET

```
#define REG_ETH_RESET 0x0020
```

Reset Eth Hardware 1=Rx, 2=Tx, 3=Both

#### 7.2.5.25 REG\_EXPOSURETIMELSB\_REG

```
#define REG_EXPOSURETIMELSB_REG 0x8207
```

Exposure time LSB

#### 7.2.5.26 REG\_EXPOSURETIMEMSB\_REG

```
#define REG_EXPOSURETIMEMSB_REG 0x8206
```

Exposure time MSB

#### 7.2.5.27 REG\_FCLK\_I2C\_ADDRESS

```
#define REG_FCLK_I2C_ADDRESS 0x8040
```

[ Slave Address(7), RD/WRn(1), Reg Address(8) ] Slave address Hx58 -> HxB when shifted up by 1

#### 7.2.5.28 REG\_FCLK\_I2C\_DATA\_RD

```
#define REG_FCLK_I2C_DATA_RD 0x8042
```

[ Read Failed (1), Write Failed(1), Toggle bit(1), 0(5), Read Data (8) ]

#### 7.2.5.29 REG\_FCLK\_I2C\_DATA\_WR

```
#define REG_FCLK_I2C_DATA_WR 0x8041
```

[ Clock Select(2), Clock Enable (1), 0(5), Write Data (8) ] Clock Select: (00): 250 MHz (01): 200 MHz (10): FPGA FCRIC Clk (11): Si570 Programmable

#### 7.2.5.30 REG\_FCLK\_SET5

```
#define REG_FCLK_SET5 0xB00C
```

FRM Status

#### 7.2.5.31 REG\_FPGA\_VERSION

```
#define REG_FPGA_VERSION 0x008F
```

Sandbox Registers

#### 7.2.5.32 REG\_FRM\_10GbE\_SEL

```
#define REG_FRM_10GbE_SEL 0x0037;
```

10GbE Link Select Clock Enables

#### 7.2.5.33 REG\_FRM\_FPGA\_VERSION

```
#define REG_FRM_FPGA_VERSION 0x808F
```

Sandbox Registers

#### 7.2.5.34 REG\_FRM\_RESET

```
#define REG_FRM_RESET 0x0036
```

Frame Reset

#### 7.2.5.35 REG\_FRM\_SANDBOX\_REG0F

```
#define REG_FRM_SANDBOX_REG0F 0x80FF
```

Image Processing Registers

### 7.2.5.36 REG\_FRM\_STREAM\_TYPE

```
#define REG_FRM_STREAM_TYPE 0x8003
```

List of Commands

### 7.2.5.37 REG\_IMON\_ADC0\_CHF

```
#define REG_IMON_ADC0_CHF 0x005B /* V5P0_FP Current Monitor (1/2) */
```

Status Registers

### 7.2.5.38 REG\_MAC\_CFG\_VECTOR1

```
#define REG_MAC_CFG_VECTOR1 0x0027
```

Ethernet Hardware Conf

### 7.2.5.39 REG\_MAC\_CFG\_VECTOR2

```
#define REG_MAC_CFG_VECTOR2 0x002D
```

Ethernet Hardware Conf Power Supply Control

### 7.2.5.40 REG\_MAC\_STATS2\_FAB2B1

```
#define REG_MAC_STATS2_FAB2B1 0x802E
```

SRAM Test Interface

### 7.2.5.41 REG\_PHY1\_MDIO\_CMD

```
#define REG_PHY1_MDIO_CMD 0x0022
```

Start(1), RnW(1), WDRd(1), PHY Addr(5), REG Addr(5)

### 7.2.5.42 REG\_PS\_ENABLE

```
#define REG_PS_ENABLE 0x0030
```

Power Supply Enable:

### 7.2.5.43 REG\_PS\_SYNC\_DIV0

```
#define REG_PS_SYNC_DIV0 0x0031
```

2.5V Gen

**7.2.5.44 REG\_PS\_SYNC\_DIV1**

```
#define REG_PS_SYNC_DIV1 0x0032
```

**3.3V Gen****7.2.5.45 REG\_PS\_SYNC\_DIV2**

```
#define REG_PS_SYNC_DIV2 0x0033
```

**2.5V Frame****7.2.5.46 REG\_PS\_SYNC\_DIV3**

```
#define REG_PS_SYNC_DIV3 0x0034
```

**0.9V Frame****7.2.5.47 REG\_PS\_SYNC\_DIV4**

```
#define REG_PS_SYNC_DIV4 0x0035
```

**5.0V FP Frame FPGA Control****7.2.5.48 REG\_SANDBOX\_REG0F**

```
#define REG_SANDBOX_REG0F 0x00FF
```

-----< Frame FPGA Registers > Command Registers

**7.2.5.49 REG\_SI570\_REG3**

```
#define REG_SI570_REG3 0x003C
```

**Power Monitor Registers****7.2.5.50 REG\_SRAM\_COMMAND**

```
#define REG_SRAM_COMMAND 0x8030
```

1 bit [0] >> Read NOT Write 2 bits [3:2] >> Modes: – Single RW 0x00 – Burst RW 0x01 – Test/Diagnostic 10 – Sleep 11 1 bit [4] >> start/stop

#### 7.2.5.51 REG\_SRAM\_STATUS0

```
#define REG_SRAM_STATUS0 0x803B
```

Programmable Clock

#### 7.2.5.52 REG\_STREAM\_TYPE

```
#define REG_STREAM_TYPE 0x0003
```

FCLK Values

#### 7.2.5.53 REG\_TRIGGERMASK\_REG

```
#define REG_TRIGGERMASK_REG 0x8051
```

[00]==SW Trigger, [01]==FP TrigIn2, [10]==FP TrigIn1, [11]==FP TrigIn1OR2

#### 7.2.5.54 REG\_TRIGGERREPETITIONTIMELSB\_REG

```
#define REG_TRIGGERREPETITIONTIMELSB_REG 0x8209
```

Trigger Cycle Time LSB

#### 7.2.5.55 REG\_TRIGGERREPETITIONTIMESB\_REG

```
#define REG_TRIGGERREPETITIONTIMESB_REG 0x8208
```

Trigger Cycle Time MSB



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