

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:

- `libbsd` (Used for string manipulation)
- `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`.

```
# 2147483647 = 2048 Mb
net.core.rmem_max=2147483647
net.core.wmem_max=2147483647
# 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

- **Stuart B. Wilkins** - [stuwilkins](#)

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

# Module Index

### 2.1 Modules

Here is a list of all modules:

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## Chapter 3

# Class Index

### 3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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## Chapter 4

# File Index

### 4.1 File List

Here is a list of all documented files with brief descriptions:

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src/ <b>cinregisters.h</b> . . . . .	??
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>fclk_program.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, const char \*ipaddr, const char \*bind\_addr, uint16\_t oport, uint16\_t iport, uint16\_t soport, uint16\_t siport)
- int [cin\\_ctl\\_destroy](#) ([cin\\_ctl\\_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,
    const char * ipaddr,
    const char * bind_addr,
    uint16_t oport,
    uint16_t iport,
    uint16_t soport,
    uint16_t siport )
```

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>ipaddr</i>	ip address of CIN base address
<i>bind_addr</i>	ip address to bind to
<i>oport</i>	output udp port of cin
<i>iport</i>	input udp port of cin
<i>soport</i>	stream output udp port of cin
<i>siport</i>	stream input udp port of cin

#### 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)
- 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)

### 5.2.1 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 Data Initialization Routines

### Functions

- int [cin\\_data\\_init](#) ([cin\\_data\\_t](#) \*cin, int packet\_buffer\_len, int frame\_buffer\_len, char \*ipaddr, uint16\_t port, char \*cin\_ipaddr, uint16\_t [cin\\_port](#), int rcvbuf, cin\_data\_callback push\_callback, cin\_data\_callback pop\_callback, void \*usr\_ptr)
- void [cin\\_data\\_stop\\_threads](#) ([cin\\_data\\_t](#) \*cin)

### 5.3.1 Detailed Description

Initialization group

### 5.3.2 Function Documentation

#### 5.3.2.1 cin\_data\_init()

```
int cin_data_init (
    cin\_data\_t * cin,
    int packet_buffer_len,
    int frame_buffer_len,
    char * ipaddr,
    uint16_t port,
    char * cin_ipaddr,
    uint16_t cin_port,
    int rcvbuf,
    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>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>ipaddr</i>	IP-Address to bind to (if NULL binds to 0.0.0.0)
<i>port</i>	UDP Port of host
<i>cin_ipaddr</i>	IP-Address of cin (if NULL defaults to standard)
<a href="#">cin_port</a>	UDP Port of CIN
<i>rcvbuf</i>	TCP/IP Kernel receive buffer size
<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

### 5.3.2.2 cin\_data\_stop\_threads()

```
void cin_data_stop_threads (
    cin_data_t * cin )
```

Stop all threads and wait

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
------------	----------------------------

## 5.4 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)

### 5.4.1 Detailed Description

Framestore Group

### 5.4.2 Function Documentation

#### 5.4.2.1 [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

<a href="#">cin</a>	Handle to the cin library
---------------------	---------------------------

#### 5.4.2.2 [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

5.4.2.3 `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

5.4.2.4 `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
------------	---------------------------

5.4.2.5 `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\_ctl Struct Reference

#### Public Attributes

- [cin\\_port\\_t](#) **ctl\_port**
- [cin\\_port\\_t](#) **stream\_port**
- [cin\\_ctl\\_config\\_t](#) **config**
- [cin\\_ctl\\_listener\\_t](#) \* **listener**
- [pthread\\_mutex\\_t](#) **access**
- [pthread\\_mutexattr\\_t](#) **access\_attr**

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

- [src/cin.h](#)

### 6.2 cin\_ctl\_config Struct Reference

#### Public Attributes

- char **name** [CIN\_CONFIG\_MAX\_STRING]
- char **firmware\_filename** [CIN\_CONFIG\_MAX\_STRING]
- int **overscan**
- int **columns**
- int **fclk**
- [uint16\\_t](#) **timing** [CIN\_CONFIG\_MAX\_DATA][2]
- int **timing\_len**
- [uint16\\_t](#) **fcric** [CIN\_CONFIG\_MAX\_DATA][2]
- int **fcric\_len**
- [uint16\\_t](#) **bias** [CIN\_CONFIG\_MAX\_DATA][2]
- int **bias\_len**

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 **board\_id**
- uint16\_t **serial\_no**
- uint16\_t **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**
- [fifo](#) \* **image\_fifo**
- [cin\\_data\\_threads\\_t](#) **listen\_thread**
- [cin\\_data\\_threads\\_t](#) **assembler\_thread**
- [cin\\_data\\_threads\\_t](#) **descramble\_thread**
- [pthread\\_mutex\\_t](#) **listen\_mutex**
- [pthread\\_mutex\\_t](#) **assembler\_mutex**
- [pthread\\_mutex\\_t](#) **descramble\_mutex**
- [pthread\\_mutex\\_t](#) **stats\_mutex**
- [pthread\\_mutex\\_t](#) **framestore\_mutex**
- [cin\\_data\\_callbacks\\_t](#) **callbacks**
- [cin\\_port\\_t](#) **dp**
- struct timespec **framerate**
- unsigned long int **dropped\_packets**
- unsigned long int **malformed\_packets**
- uint16\_t **last\_frame**
- [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 \*(\* **pop**)([cin\\_data\\_frame\\_t](#) \*)
- [cin\\_data\\_frame\\_t](#) \* **frame**

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

- [src/cin.h](#)

## 6.9 cin\_data\_frame Struct Reference

### Public Attributes

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

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

- src/[cin.h](#)

## 6.10 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

## 6.11 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

## 6.12 cin\_data\_stats Struct Reference

### Public Attributes

- int **last\_frame**
- double **framerate**
- double **datarate**
- 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 **malformed\_packets**

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

- src/[cin.h](#)

## 6.13 cin\_data\_threads Struct Reference

### Public Attributes

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

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

- src/[cin.h](#)

## 6.14 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

## 6.15 cin\_port Struct Reference

### Public Attributes

- char \* **srvaddr**
- char \* **cliaddr**
- uint16\_t **srvport**
- uint16\_t **cliport**
- int **sockfd**
- struct timeval **tv**
- struct sockaddr\_in **sin\_srv**
- struct sockaddr\_in **sin\_cli**
- socklen\_t **slen**
- int **rcvbuf**
- int **rcvbuf\_rb**

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

- [src/cin.h](#)

## 6.16 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](#)

## 6.17 fifo Struct Reference

### Public Attributes

- void \* **data**
- void \* **head**
- void \* **tail** [FIFO\_MAX\_READERS]
- void \* **end**
- int **readers**
- 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 [cin\\_ctl\\_config](#)
- struct [fifo](#)
- struct [cin\\_ctl\\_listener](#)
- struct [cin\\_port](#)
- struct [cin\\_ctl](#)
- struct [cin\\_data\\_frame](#)
- struct [cin\\_data\\_stats](#)
- struct [cin\\_data\\_threads](#)
- struct [cin\\_data\\_callbacks](#)
- struct [descramble\\_map\\_t](#)
- struct [cin\\_data](#)
- struct [cin\\_ctl\\_id](#)
- struct [cin\\_ctl\\_pwr\\_val](#)
- struct [cin\\_ctl\\_pwr\\_mon\\_t](#)

#### Macros

- #define **CIN\_CTL\_IP** "192.168.1.207"
- #define **CIN\_CTL\_SVR\_PORT** 49200
- #define **CIN\_CTL\_CLI\_PORT** 50200
- #define **CIN\_CTL\_SVR\_FRMW\_PORT** 49202
- #define **CIN\_CTL\_CLI\_FRMW\_PORT** 50202

- #define **CIN\_CTL\_RCVBUF** 10
- #define **CIN\_CTL\_MAX\_READ\_TRIES** 10
- #define **CIN\_CTL\_MAX\_WRITE\_TRIES** 5
- #define **CIN\_CTL\_WRITE\_SLEEP** 2000
- #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_CTL_FO_REG4 0x8001`
- `#define CIN_CTL_FO_REG5 0x8211`
- `#define CIN_CTL_FO_REG6 0x8212`
- `#define CIN_CTL_FO_REG7 0x8213`
- `#define CIN_DATA_IP "10.0.5.207"`
- `#define CIN_DATA_PORT 49201`
- `#define CIN_DATA_CTL_PORT 49203`
- `#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`
- `#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 NUM_BIAS_VOLTAGE 20`
- `#define pt_posH 0`
- `#define pt_negH 1`
- `#define pt_posRG 2`
- `#define pt_negRG 3`
- `#define pt_posSW 4`
- `#define pt_negSW 5`
- `#define pt_posV 6`
- `#define pt_negV 7`
- `#define pt_posTG 8`
- `#define pt_negTG 9`
- `#define pt_posVF 10`
- `#define pt_negVF 11`
- `#define pt_NEDGE 12`
- `#define pt_OTG 13`

- `#define pt_VDDR 14`
- `#define pt_VDD_OUT 15`
- `#define pt_BUF_Base 16`
- `#define pt_BUF_Delta 17`
- `#define pt_Spare1 18`
- `#define pt_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 256`
- `#define CIN_CONFIG_MAX_DATA 5000`
- `#define FIFO_MAX_READERS 10`

## Typedefs

- `typedef struct cin_ctl_config cin_ctl_config_t`
- `typedef struct cin_ctl_listener cin_ctl_listener_t`
- `typedef struct cin_port cin_port_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 *)`
- `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, const char *ipaddr, const char *bind_addr, uint16_t oport, uint16_t iport, uint16_t soport, uint16_t siport)`
- `int cin_ctl_destroy(cin_ctl_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_config(cin_ctl_t *cin, char *filename)`
- `int cin_ctl_load_firmware(cin_ctl_t *cin)`
- `int cin_ctl_load_firmware_file(cin_ctl_t *cin, char *filename)`
- `int cin_ctl_get_fclk(cin_ctl_t *cin, int *clkfreq)`
- `int cin_ctl_set_fclk(cin_ctl_t *cin, int clkfreq)`



- int [cin\\_ctl\\_get\\_cfg\\_fpga\\_status](#) ([cin\\_ctl\\_t](#) \*cin, uint16\_t \*\_val)
- int [cin\\_ctl\\_get\\_id](#) ([cin\\_ctl\\_t](#) \*cin, [cin\\_ctl\\_id\\_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\\_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\\_bias](#) ([cin\\_ctl\\_t](#) \*cin, int val)
- int [cin\\_ctl\\_get\\_bias](#) ([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\\_get\\_bias\\_voltages](#) ([cin\\_ctl\\_t](#) \*cin, float \*voltage)
- int [cin\\_ctl\\_set\\_bias\\_voltages](#) ([cin\\_ctl\\_t](#) \*cin, float \*voltage)
- int [cin\\_ctl\\_set\\_fabric\\_address](#) ([cin\\_ctl\\_t](#) \*cin, char \*ip)
- 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\\_data\\_init](#) ([cin\\_data\\_t](#) \*cin, int packet\_buffer\_len, int frame\_buffer\_len, char \*ipaddr, uint16\_t port, char \*cin\_ipaddr, uint16\_t [cin\\_port](#), int rcvbuf, cin\_data\_callback push\_callback, cin\_data\_callback pop\_callback, void \*usr\_ptr)
- void [cin\\_data\\_stop\\_threads](#) ([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)

## 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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### 7.1.3 DESCRIPTION

header file for CIN communications

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