

libcin

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Contents

1	FastCCD Communication Library (libcin)	1
2	Module Index	3
2.1	Modules	3
3	Class Index	5
3.1	Class List	5
4	File Index	7
4.1	File List	7
5	Module Documentation	9
5.1	Cin Control Initialization Routines	9
5.1.1	Detailed Description	9
5.1.2	Function Documentation	9
5.1.2.1	cin_ctl_destroy()	9
5.1.2.2	cin_ctl_init()	10
5.1.2.3	cin_ctl_set_msg_callback()	10
5.1.2.4	cin_data_send_magic()	11
5.2	Cin Control Read/Rwrite Routines	12
5.2.1	Detailed Description	12
5.2.2	Function Documentation	12
5.2.2.1	cin_ctl_read()	12
5.2.2.2	cin_ctl_stream_write()	12
5.2.2.3	cin_ctl_write()	13

5.2.2.4	cin_ctl_write_with_readback()	13
5.3	Cin Power Routines	15
5.3.1	Detailed Description	15
5.3.2	Function Documentation	15
5.3.2.1	cin_ctl_fo_test_pattern()	15
5.3.2.2	cin_ctl_fp_pwr()	15
5.3.2.3	cin_ctl_pwr()	15
5.4	CIN Firmware Upload Routines	16
5.4.1	Detailed Description	16
5.4.2	Function Documentation	16
5.4.2.1	cin_ctl_load_config()	16
5.4.2.2	cin_ctl_load_firmware()	16
5.4.2.3	cin_ctl_load_firmware_data()	17
5.4.2.4	cin_ctl_load_firmware_file()	17
5.5	CIN FCLK Configuration Routines	18
5.5.1	Detailed Description	18
5.5.2	Function Documentation	18
5.5.2.1	cin_ctl_get_fclk()	18
5.5.2.2	cin_ctl_set_fclk()	18
5.6	CIN Status Routines	19
5.6.1	Detailed Description	19
5.7	CIN Control Bias Routines	20
5.7.1	Detailed Description	20
5.8	CIN Control Timing Routines	21
5.8.1	Detailed Description	21
5.8.2	Function Documentation	21
5.8.2.1	cin_config_get_timing_name()	21
5.9	CIN Data Initialization Routines	22
5.9.1	Detailed Description	22
5.9.2	Function Documentation	22
5.9.2.1	cin_data_destroy()	22
5.9.2.2	cin_data_init()	22
5.10	CIN Data Framestore Functions	25
5.10.1	Detailed Description	25
5.10.2	Function Documentation	25
5.10.2.1	cin_data_framestore_disable()	25
5.10.2.2	cin_data_framestore_skip()	25
5.10.2.3	cin_data_framestore_trigger()	26
5.10.2.4	cin_data_framestore_trigger_enable()	26
5.10.2.5	cin_data_get_framestore_counter()	26

6 Class Documentation	29
6.1 cin_config_timing Struct Reference	29
6.1.1 Member Data Documentation	29
6.1.1.1 cols	29
6.1.1.2 data	29
6.1.1.3 data_len	29
6.1.1.4 fclk_freq	30
6.1.1.5 framestore	30
6.1.1.6 name	30
6.1.1.7 overscan	30
6.1.1.8 rows	30
6.2 cin_ctl Struct Reference	30
6.2.1 Member Data Documentation	31
6.2.1.1 fclk_time_factor	31
6.3 cin_ctl_id Struct Reference	31
6.4 cin_ctl_listener Struct Reference	31
6.5 cin_ctl_pwr_mon_t Struct Reference	32
6.6 cin_ctl_pwr_val Struct Reference	32
6.7 cin_data Struct Reference	32
6.8 cin_data_callbacks Struct Reference	33
6.9 cin_data_descramble_map_t Struct Reference	33
6.10 cin_data_frame Struct Reference	34
6.11 cin_data_packet Struct Reference	34
6.12 cin_data_proc Struct Reference	34
6.13 cin_data_stats Struct Reference	35
6.14 cin_data_threads Struct Reference	35
6.15 cin_map_t Struct Reference	35
6.16 cin_port Struct Reference	36
6.17 fifo Struct Reference	36

7 File Documentation	37
7.1 src/cin.h File Reference	37
7.1.1 Detailed Description	42
7.1.2 LICENSE	43
7.1.3 DESCRIPTION	43
7.1.4 Macro Definition Documentation	43
7.1.4.1 CIN_CONFIG_MAX_TIMING_DATA	43
7.1.4.2 CIN_CONFIG_MAX_TIMING_MODES	43
7.1.4.3 CIN_CTL_BIAS_OFFSET	44
7.2 src/cin_register_map.h File Reference	44
7.2.1 Detailed Description	49
7.2.2 LICENSE	49
7.2.3 DESCRIPTION	49
7.2.4 TIMING	49
7.2.5 Macro Definition Documentation	49
7.2.5.1 CMD_DISABLE_CLKS	50
7.2.5.2 CMD_ENABLE_CLKS	50
7.2.5.3 CMD_FCLK_250	50
7.2.5.4 CMD_FCLK_COMMIT	50
7.2.5.5 CMD_MON_START	50
7.2.5.6 CMD_MON_STOP	50
7.2.5.7 CMD_PS_ENABLE	50
7.2.5.8 CMD_PS_POWERDOWN	50
7.2.5.9 CMD_READ_REG	51
7.2.5.10 CMD_RESET_FRAME_COUNT	51
7.2.5.11 CMD_SEND_FCRIC_CONFIG	51
7.2.5.12 CMD_SEND_SYNC_PULSE	51
7.2.5.13 CMD_SYNC_DETECTOR2READOUT	51
7.2.5.14 CMD_WR_CCD_BIAS_REG	51
7.2.5.15 CMD_WR_CCD_CLOCK_REG	51

7.2.5.16	REG_BIASCONFIGREGISTER0_REG	51
7.2.5.17	REG_BIASREGISTERDATAOUT	52
7.2.5.18	REG_CLOCK_EN_REG	52
7.2.5.19	REG_CLOCKCONFIGREGISTER0_REG	52
7.2.5.20	REG_COMMAND	52
7.2.5.21	REG_DEBUGCOUNTER04_REG	52
7.2.5.22	REG_DELAYTOSHUTTERLSB_REG	52
7.2.5.23	REG_ETH_ENABLE	52
7.2.5.24	REG_ETH_RESET	53
7.2.5.25	REG_EXPOSURETIMELSB_REG	53
7.2.5.26	REG_EXPOSURETIMEMSB_REG	53
7.2.5.27	REG_FCLK_I2C_ADDRESS	53
7.2.5.28	REG_FCLK_I2C_DATA_RD	53
7.2.5.29	REG_FCLK_I2C_DATA_WR	53
7.2.5.30	REG_FCLK_SET5	53
7.2.5.31	REG_FPGA_VERSION	54
7.2.5.32	REG_FRM_10GbE_SEL	54
7.2.5.33	REG_FRM_FPGA_VERSION	54
7.2.5.34	REG_FRM_RESET	54
7.2.5.35	REG_FRM_SANDBOX_REG0F	54
7.2.5.36	REG_FRM_STREAM_TYPE	54
7.2.5.37	REG_IMON_ADC0_CHF	54
7.2.5.38	REG_MAC_CFG_VECTOR1	54
7.2.5.39	REG_MAC_CFG_VECTOR2	55
7.2.5.40	REG_MAC_STATS2_FAB2B1	55
7.2.5.41	REG_PHY1_MDIO_CMD	55
7.2.5.42	REG_PS_ENABLE	55
7.2.5.43	REG_PS_SYNC_DIV0	55
7.2.5.44	REG_PS_SYNC_DIV1	55
7.2.5.45	REG_PS_SYNC_DIV2	55
7.2.5.46	REG_PS_SYNC_DIV3	55
7.2.5.47	REG_PS_SYNC_DIV4	56
7.2.5.48	REG_SANDBOX_REG0F	56
7.2.5.49	REG_SI570_REG3	56
7.2.5.50	REG_SRAM_COMMAND	56
7.2.5.51	REG_SRAM_STATUS0	56
7.2.5.52	REG_STREAM_TYPE	56
7.2.5.53	REG_TRIGGERMASK_REG	56
7.2.5.54	REG_TRIGGERREPETITIONTIMELSB_REG	56
7.2.5.55	REG_TRIGGERREPETITIONTIMEMSB_REG	56

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](#).

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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

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Chapter 2

Module Index

2.1 Modules

Here is a list of all modules:

Cin Control Initialization Routines	9
Cin Control Read/Rwrite Routines	12
Cin Power Routines	15
CIN Firmware Upload Routines	16
CIN FCLK Configuration Routines	18
CIN Status Routines	19
CIN Control Bias Routines	20
CIN Control Timing Routines	21
CIN Data Initialization Routines	22
CIN Data Framestore Functions	25

Chapter 3

Class Index

3.1 Class List

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

cin_config_timing	29
cin_ctl	30
cin_ctl_id	31
cin_ctl_listener	31
cin_ctl_pwr_mon_t	32
cin_ctl_pwr_val	32
cin_data	32
cin_data_callbacks	33
cin_data_descramble_map_t	33
cin_data_frame	34
cin_data_packet	34
cin_data_proc	34
cin_data_stats	35
cin_data_threads	35
cin_map_t	35
cin_port	36
fifo	36

Chapter 4

File Index

4.1 File List

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

src/ cin.h	37
src/ cin_register_map.h	44
src/ cinregisters.h	??
src/ common.h	??
src/ config.h	??
src/ control.h	??
src/ data.h	??
src/ descramble.h	??
src/ descramble_map.h	??
src/ fifo.h	??
src/ report.h	??

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 wait)
- 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,
    int wait )
```

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
<i>wait</i>	if non-zero, wait a predefined time before read command (for i2c)

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_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)

5.6.1 Detailed Description

Status Routines

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)

5.8.1 Detailed Description

Timing setup group

5.8.2 Function Documentation

5.8.2.1 `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 cin_data 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 cin_data 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 cin_data 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](#) [40]
- 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[40]
```

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 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_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_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** 20

Typedefs

- typedef struct **cin_ctl_listener** **cin_ctl_listener_t**
- typedef struct **cin_port** **cin_port_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 wait)
- 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_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_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_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, const char *mode)
- 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

Author

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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 20
```

20 states max

7.1.4.3 CIN_CTL_BIAS_OFFSET

```
#define CIN_CTL_BIAS_OFFSET 0x0030
```

Offset in address to read bias

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_EXPOSURETIMESB_REG

```
#define REG_EXPOSURETIMESB_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

Index

- CIN Control Bias Routines, [20](#)
- CIN Control Timing Routines, [21](#)
 - [cin_config_get_timing_name](#), [21](#)
- CIN Data Framestore Functions, [25](#)
 - [cin_data_framestore_disable](#), [25](#)
 - [cin_data_framestore_skip](#), [25](#)
 - [cin_data_framestore_trigger](#), [26](#)
 - [cin_data_framestore_trigger_enable](#), [26](#)
 - [cin_data_get_framestore_counter](#), [26](#)
- CIN Data Initialization Routines, [22](#)
 - [cin_data_destroy](#), [22](#)
 - [cin_data_init](#), [22](#)
- CIN FCLK Configuration Routines, [18](#)
 - [cin_ctl_get_fclk](#), [18](#)
 - [cin_ctl_set_fclk](#), [18](#)
- CIN Firmware Upload Routines, [16](#)
 - [cin_ctl_load_config](#), [16](#)
 - [cin_ctl_load_firmware](#), [16](#)
 - [cin_ctl_load_firmware_data](#), [16](#)
 - [cin_ctl_load_firmware_file](#), [17](#)
- CIN Status Routines, [19](#)
- CIN_CONFIG_MAX_TIMING_DATA
 - [cin.h](#), [43](#)
- CIN_CONFIG_MAX_TIMING_MODES
 - [cin.h](#), [43](#)
- CIN_CTL_BIAS_OFFSET
 - [cin.h](#), [43](#)
- CMD_DISABLE_CLKS
 - [cin_register_map.h](#), [49](#)
- CMD_ENABLE_CLKS
 - [cin_register_map.h](#), [50](#)
- CMD_FCLK_250
 - [cin_register_map.h](#), [50](#)
- CMD_FCLK_COMMIT
 - [cin_register_map.h](#), [50](#)
- CMD_MON_START
 - [cin_register_map.h](#), [50](#)
- CMD_MON_STOP
 - [cin_register_map.h](#), [50](#)
- CMD_PS_ENABLE
 - [cin_register_map.h](#), [50](#)
- CMD_PS_POWERDOWN
 - [cin_register_map.h](#), [50](#)
- CMD_READ_REG
 - [cin_register_map.h](#), [50](#)
- CMD_RESET_FRAME_COUNT
 - [cin_register_map.h](#), [51](#)
- CMD_SEND_FCRIC_CONFIG
 - [cin_register_map.h](#), [51](#)
- CMD_SEND_SYNC_PULSE
 - [cin_register_map.h](#), [51](#)
- CMD_SYNC_DETECTOR2READOUT
 - [cin_register_map.h](#), [51](#)
- CMD_WR_CCD_BIAS_REG
 - [cin_register_map.h](#), [51](#)
- CMD_WR_CCD_CLOCK_REG
 - [cin_register_map.h](#), [51](#)
- Cin Control Initialization Routines, [9](#)
 - [cin_ctl_destroy](#), [9](#)
 - [cin_ctl_init](#), [10](#)
 - [cin_ctl_set_msg_callback](#), [10](#)
 - [cin_data_send_magic](#), [11](#)
- Cin Control Read/Rwrite Routines, [12](#)
 - [cin_ctl_read](#), [12](#)
 - [cin_ctl_stream_write](#), [12](#)
 - [cin_ctl_write](#), [13](#)
 - [cin_ctl_write_with_readback](#), [13](#)
- Cin Power Routines, [15](#)
 - [cin_ctl_fo_test_pattern](#), [15](#)
 - [cin_ctl_fp_pwr](#), [15](#)
 - [cin_ctl_pwr](#), [15](#)
- [cin.h](#)
 - [CIN_CONFIG_MAX_TIMING_DATA](#), [43](#)
 - [CIN_CONFIG_MAX_TIMING_MODES](#), [43](#)
 - [CIN_CTL_BIAS_OFFSET](#), [43](#)
- [cin_config_get_timing_name](#)
 - CIN Control Timing Routines, [21](#)
- [cin_config_timing](#), [29](#)
 - [cols](#), [29](#)
 - [data](#), [29](#)
 - [data_len](#), [29](#)
 - [fclk_freq](#), [29](#)
 - [framestore](#), [30](#)
 - [name](#), [30](#)
 - [overscan](#), [30](#)
 - [rows](#), [30](#)
- [cin_ctl](#), [30](#)
 - [fclk_time_factor](#), [31](#)
- [cin_ctl_destroy](#)
 - Cin Control Initialization Routines, [9](#)
- [cin_ctl_fo_test_pattern](#)
 - Cin Power Routines, [15](#)
- [cin_ctl_fp_pwr](#)
 - Cin Power Routines, [15](#)
- [cin_ctl_get_fclk](#)
 - CIN FCLK Configuration Routines, [18](#)
- [cin_ctl_id](#), [31](#)
- [cin_ctl_init](#)

- Cin Control Initialization Routines, 10
- cin_ctl_listener, 31
- cin_ctl_load_config
 - CIN Firmware Upload Routines, 16
- cin_ctl_load_firmware
 - CIN Firmware Upload Routines, 16
- cin_ctl_load_firmware_data
 - CIN Firmware Upload Routines, 16
- cin_ctl_load_firmware_file
 - CIN Firmware Upload Routines, 17
- cin_ctl_pwr
 - Cin Power Routines, 15
- cin_ctl_pwr_mon_t, 32
- cin_ctl_pwr_val, 32
- cin_ctl_read
 - Cin Control Read/Rwrite Routines, 12
- cin_ctl_set_fclk
 - CIN FCLK Configuration Routines, 18
- cin_ctl_set_msg_callback
 - Cin Control Initialization Routines, 10
- cin_ctl_stream_write
 - Cin Control Read/Rwrite Routines, 12
- cin_ctl_write
 - Cin Control Read/Rwrite Routines, 13
- cin_ctl_write_with_readback
 - Cin Control Read/Rwrite Routines, 13
- cin_data, 32
- cin_data_callbacks, 33
- cin_data_descramble_map_t, 33
- cin_data_destroy
 - CIN Data Initialization Routines, 22
- cin_data_frame, 34
- cin_data_framestore_disable
 - CIN Data Framestore Functions, 25
- cin_data_framestore_skip
 - CIN Data Framestore Functions, 25
- cin_data_framestore_trigger
 - CIN Data Framestore Functions, 26
- cin_data_framestore_trigger_enable
 - CIN Data Framestore Functions, 26
- cin_data_get_framestore_counter
 - CIN Data Framestore Functions, 26
- cin_data_init
 - CIN Data Initialization Routines, 22
- cin_data_packet, 34
- cin_data_proc, 34
- cin_data_send_magic
 - Cin Control Initialization Routines, 11
- cin_data_stats, 35
- cin_data_threads, 35
- cin_map_t, 35
- cin_port, 36
- cin_register_map.h
 - CMD_DISABLE_CLKS, 49
 - CMD_ENABLE_CLKS, 50
 - CMD_FCLK_250, 50
 - CMD_FCLK_COMMIT, 50
 - CMD_MON_START, 50
 - CMD_MON_STOP, 50
 - CMD_PS_ENABLE, 50
 - CMD_PS_POWERDOWN, 50
 - CMD_READ_REG, 50
 - CMD_RESET_FRAME_COUNT, 51
 - CMD_SEND_FCRIC_CONFIG, 51
 - CMD_SEND_SYNC_PULSE, 51
 - CMD_SYNC_DETECTOR2READOUT, 51
 - CMD_WR_CCD_BIAS_REG, 51
 - CMD_WR_CCD_CLOCK_REG, 51
 - REG_BIASCONFIGREGISTER0_REG, 51
 - REG_BIASREGISTERDATAOUT, 51
 - REG_CLOCK_EN_REG, 52
 - REG_CLOCKCONFIGREGISTER0_REG, 52
 - REG_COMMAND, 52
 - REG_DEBUGCOUNTER04_REG, 52
 - REG_DELAYTOSHUTTERLSB_REG, 52
 - REG_ETH_ENABLE, 52
 - REG_ETH_RESET, 52
 - REG_EXPOSURETIMELSB_REG, 53
 - REG_EXPOSURETIMEMSB_REG, 53
 - REG_FCLK_I2C_ADDRESS, 53
 - REG_FCLK_I2C_DATA_RD, 53
 - REG_FCLK_I2C_DATA_WR, 53
 - REG_FCLK_SET5, 53
 - REG_FPGA_VERSION, 53
 - REG_FRM_10GbE_SEL, 54
 - REG_FRM_FPGA_VERSION, 54
 - REG_FRM_RESET, 54
 - REG_FRM_SANDBOX_REG0F, 54
 - REG_FRM_STREAM_TYPE, 54
 - REG_IMON_ADC0_CHF, 54
 - REG_MAC_CFG_VECTOR1, 54
 - REG_MAC_CFG_VECTOR2, 54
 - REG_MAC_STATS2_FAB2B1, 55
 - REG_PHY1_MDIO_CMD, 55
 - REG_PS_ENABLE, 55
 - REG_PS_SYNC_DIV0, 55
 - REG_PS_SYNC_DIV1, 55
 - REG_PS_SYNC_DIV2, 55
 - REG_PS_SYNC_DIV3, 55
 - REG_PS_SYNC_DIV4, 55
 - REG_SANDBOX_REG0F, 56
 - REG_SI570_REG3, 56
 - REG_SRAM_COMMAND, 56
 - REG_SRAM_STATUS0, 56
 - REG_STREAM_TYPE, 56
 - REG_TRIGGERMASK_REG, 56
 - REG_TRIGGERREPETITIONTIMELSB_REG, 56
 - REG_TRIGGERREPETITIONTIMEMSB_REG, 56
- cols
 - cin_config_timing, 29
- data
 - cin_config_timing, 29
- data_len
 - cin_config_timing, 29
- fclk_freq

- cin_config_timing, [29](#)
- fclk_time_factor
 - cin_ctl, [31](#)
- fifo, [36](#)
- framestore
 - cin_config_timing, [30](#)
- name
 - cin_config_timing, [30](#)
- overscan
 - cin_config_timing, [30](#)
- REG_BIASCONFIGREGISTER0_REG
 - cin_register_map.h, [51](#)
- REG_BIASREGISTERDATAOUT
 - cin_register_map.h, [51](#)
- REG_CLOCK_EN_REG
 - cin_register_map.h, [52](#)
- REG_CLOCKCONFIGREGISTER0_REG
 - cin_register_map.h, [52](#)
- REG_COMMAND
 - cin_register_map.h, [52](#)
- REG_DEBUGCOUNTER04_REG
 - cin_register_map.h, [52](#)
- REG_DELAYTOSHUTTERLSB_REG
 - cin_register_map.h, [52](#)
- REG_ETH_ENABLE
 - cin_register_map.h, [52](#)
- REG_ETH_RESET
 - cin_register_map.h, [52](#)
- REG_EXPOSURETIMELSB_REG
 - cin_register_map.h, [53](#)
- REG_EXPOSURETIMEMSB_REG
 - cin_register_map.h, [53](#)
- REG_FCLK_I2C_ADDRESS
 - cin_register_map.h, [53](#)
- REG_FCLK_I2C_DATA_RD
 - cin_register_map.h, [53](#)
- REG_FCLK_I2C_DATA_WR
 - cin_register_map.h, [53](#)
- REG_FCLK_SET5
 - cin_register_map.h, [53](#)
- REG_FPGA_VERSION
 - cin_register_map.h, [53](#)
- REG_FRM_10GbE_SEL
 - cin_register_map.h, [54](#)
- REG_FRM_FPGA_VERSION
 - cin_register_map.h, [54](#)
- REG_FRM_RESET
 - cin_register_map.h, [54](#)
- REG_FRM_SANDBOX_REG0F
 - cin_register_map.h, [54](#)
- REG_FRM_STREAM_TYPE
 - cin_register_map.h, [54](#)
- REG_IMON_ADC0_CHF
 - cin_register_map.h, [54](#)
- REG_MAC_CFG_VECTOR1
 - cin_register_map.h, [54](#)
- REG_MAC_CFG_VECTOR2
 - cin_register_map.h, [54](#)
- REG_MAC_STATS2_FAB2B1
 - cin_register_map.h, [55](#)
- REG_PHY1_MDIO_CMD
 - cin_register_map.h, [55](#)
- REG_PS_ENABLE
 - cin_register_map.h, [55](#)
- REG_PS_SYNC_DIV0
 - cin_register_map.h, [55](#)
- REG_PS_SYNC_DIV1
 - cin_register_map.h, [55](#)
- REG_PS_SYNC_DIV2
 - cin_register_map.h, [55](#)
- REG_PS_SYNC_DIV3
 - cin_register_map.h, [55](#)
- REG_PS_SYNC_DIV4
 - cin_register_map.h, [55](#)
- REG_SANDBOX_REG0F
 - cin_register_map.h, [56](#)
- REG_SI570_REG3
 - cin_register_map.h, [56](#)
- REG_SRAM_COMMAND
 - cin_register_map.h, [56](#)
- REG_SRAM_STATUS0
 - cin_register_map.h, [56](#)
- REG_STREAM_TYPE
 - cin_register_map.h, [56](#)
- REG_TRIGGERMASK_REG
 - cin_register_map.h, [56](#)
- REG_TRIGGERREPETITIONIMELSB_REG
 - cin_register_map.h, [56](#)
- REG_TRIGGERREPETITIONIMEMSB_REG
 - cin_register_map.h, [56](#)
- rows
 - cin_config_timing, [30](#)
- src/cin.h, [37](#)
- src/cin_register_map.h, [44](#)