

EX94421

Analog Input Card

Software Manual (V1.0)

旭蒙科技股份有限公司

TOPSCCC TECHNOLOGY CO., LTD.

台北市內湖區陽光街 345 巷 12 號 5 樓

5F., No.12, Lane 345, Yang Guang St.

Neihu, 114 Taipei, Taiwan

TEL : +886-2-2799-9080

FAX : +886-2-2658-5042

<http://www.topscce.com>

E-mail : jane.w@topscce.com

Correction record

| Version | Record |
|---------|--------|
| 1.0 | |

Contents

| | | |
|-----|--|----|
| 1. | About the EX94421 software | 3 |
| 1.1 | What you need to get started..... | 3 |
| 2. | How to install linux driver | 4 |
| 3. | Software overview and dll function..... | 5 |
| 3.1 | Initialization and close | 5 |
| | EX94421_initial..... | 5 |
| | EX94421_close..... | 5 |
| | EX94421_info..... | 5 |
| 3.2 | Analog input | 6 |
| | EX94421_AD_config_set..... | 6 |
| | EX94421_AD_config_read | 7 |
| | EX94421_AD_value_read..... | 7 |
| | EX94421_AD_data_read..... | 8 |
| | EX94421_AD_integral_start | 9 |
| | EX94421_AD_integral_all_read | 9 |
| | EX94421_AD_integral_stop | 10 |
| 3.3 | Error conditions | 11 |
| 4. | Flow chart of application implementation..... | 12 |
| 4.1 | EX94421 Flow chart of analog I/O application implementation..... | 12 |
| 4.2 | EX94421 Flow chart of analog I/O application with embedded integration function..... | 13 |
| 5. | Dll list | 14 |
| 6. | EX94421 Error codes summary..... | 15 |
| 6.1 | EX94421 Error codes table..... | 15 |

1. **About the EX94421 software**

EX94421 software includes a set of dynamic link library (.so) and system driver that you can utilize to control the I/O card's ports and points separately.

Your EX94421 software package includes setup driver, tutorial example and test program that help you how to setup and run appropriately, as well as an executable file which you can use to test each of the EX94421 functions within Windows' operation system environment.

1.1 What you need to get started

To set up and use your EX94421 software, you need the following:

- EX94421 software
- EX94421 hardware

Main board

Wiring board (Option)

2. **How to install linux driver**

--To unpack the file, use the "tar" command, Use the syntax :

```
$tar -zxvf <filename>
```

This creates the EX94421 directory, containing installation scripts, Makefile, driver source , dynamic library, demo source and executing.

--Change to <filename> directory.

```
$cd <filename>
```

--First install, type "make" to compile the source.

```
$make clean
```

```
$make
```

You may see the drv94421.ko module file.

--We will install modules, Dynamic library, Demo and shell script on boot, Use the script command :

```
$/install94421 setup
```

--Then load modules and create device :

```
$/install94421 start
```

--Executing demo, You can use the following commands under any directory.

```
$EX94421demo
```

--Want to uninstall EX94421 driver , can use the command :

```
$/install94421 uninstall
```

Note : if you change CardID,please type "./install94421 reload" command first.

Note : if you executing demo and returns error,maybe you have not install QT or KDE library.

Please install QT or KDE by the following instruction:

```
yum install qt*(kde*)
```

3. Software overview and dll function

These topics describe the features and functionality of the EX94421 boards and briefly describes the EX94421 functions.

3.1 Initialization and close

You need to initialize system resource each time you start to run your application.

EX94421_initial() will do.

Once you want to close your application, call

EX94421_close() to release all the resource.

If you want to know the physical address assigned by OS. use

EX94421_info() to get the address.

● EX94421_initial

Format : u32 Status =EX94421_initial (void)

Purpose: Initial the EX94421 resource when start the Windows applications.

● EX94421_close

Format : u32 Status =EX94421_close (void);

Purpose: Release the EX94421 resource when close the Windows applications.

● EX94421_info

Format : u32 status =EX94421_info(u8 CardID,u16 *address)

Purpose: Read the physical I/O address assigned by O.S..

Parameters:

Input:

| Name | Type | Description |
|--------|------|---------------------------|
| CardID | u8 | assigned by DIP/ROTARY SW |

Output:

| Name | Type | Description |
|---------|------|-------------------------------------|
| address | u16 | physical I/O address assigned by OS |

3.2 Analog input

The EX94421 now is a 16 bit AD cards. You must configure the input range of the specific channel by:

EX94421_AD_config_set() and read back the configuration for verification by:

EX94421_AD_config_read()

To read the input voltage value by:

EX94421_AD_value_read(), it can be also read data by

EX94421_AD_data_read()

The EX94421 hardware only provide the AD conversion data on the fly, in noisy environment the conversion result maybe contaminated by noise, to use the integral of signals will eliminate the high frequency noise. The dll has provide build in software integration functions; to start the function by:

EX94421_AD_integral_start() and read the integration data by

EX94421_AD_integral_all_read(), if you want to stop the integration function don't forget to release the resource and stop integration by:

EX94421_AD_integral_stop()

● **EX94421 AD config set**

Format : u32 status = EX94421_AD_config_set(u8 CardID,u8 channel,u8 mode)

Purpose: Set A/D config.

Parameters:

Input:

| Name | Type | Description |
|---------|------|---|
| CardID | u8 | assigned by DIP/ROTARY SW |
| channel | u8 | A/D channel number 0~7: EX94421, 8 channels AD |
| mode | u8 | scale range: 0: 0V ~ 5V 1: -5V ~ +5V 2: 0V ~ 10V 3: -10V ~ +10V 255 : AD stop operation. |

● EX94421 AD config read

Format : u32 status = EX94421_AD_config_read(u8 CardID,u8 channel,u8 *mode)

Purpose: Read A/D configuration.

Parameters:

Input:

| Name | Type | Description |
|---------|------|---|
| CardID | u8 | assigned by DIP/ROTARY SW |
| channel | u8 | A/D channel number 0~7: EX94421, 8 channels AD |

Output:

| Name | Type | Description |
|------|------|---|
| mode | u8 | scale range: 0: 0V ~ 5V 1: -5V ~ +5V (Default) 2: 0V ~ 10V 3: -10V ~ +10V 255 : AD stop operation. |

● EX94421 AD value read

Format : u32 status = EX94421_AD_value_read(u8 CardID,u8 channel,
f32 *voltage_value)

Purpose: Read voltage value with pre-calibration data.

Parameters:

Input:

| Name | Type | Description |
|---------|------|---|
| CardID | u8 | assigned by DIP/ROTARY SW |
| channel | u8 | A/D channel number 0~7: EX94421, 8 channels AD |

Output:

| Name | Type | Description |
|---------------|------|--|
| voltage_value | f32 | Voltage value based on the AD converted and calibrated data. Say if the AD scale range is set at 0~5V then the voltage value returned will be in the 0~5 range. |

- **EX94421 AD data read**

Format : u32 status = EX94421_AD_data_read(u8 CardID,u8 channel,
u16 *voltage_data)

Purpose: Read voltage value with pre-calibration data.

Parameters:

Input:

| Name | Type | Description |
|---------|------|---|
| CardID | u8 | assigned by DIP/ROTARY SW |
| channel | u8 | A/D channel number 0~7: EX94421, 8 channels AD |

Output:

| Name | Type | Description |
|--------------|------|--|
| voltage_data | u16 | Voltage value based on the AD converted data. If unipolar voltage: 0~5V or 0~10V is 0~65535 If bipolar voltage, please take the data as 2's complement, change to i16 first then -5V~+5V or -10V~+10V is -32768 ~ +32767 |

● EX94421 AD integral start

Format : u32 status = EX94421_AD_integral_start(u8 CardID,u8 mode)

Purpose: start AD conversion with integral constant.

Parameters:

Input:

| Name | Type | Description |
|--------|------|---|
| CardID | u8 | assigned by jumper setting |
| mode | u8 | 0: immediately access, no integration 1: integration time 100ms 2: integration time 200ms 3: integration time 300ms 4: integration time 400ms 5: integration time 500ms 6: integration time 600ms 7: integration time 700ms 8: integration time 800ms 9: integration time 900ms 10: integration time 1s |

● EX94421 AD integral all read

Format : u32 status = EX94421_AD_integral_all_read(u8 CardID,i16 data[8])

Purpose: read one port integral result of AD conversion data.

Parameters:

Input:

| Name | Type | Description |
|--------|------|----------------------------|
| CardID | u8 | assigned by jumper setting |

Output:

| Name | Type | Description |
|---------|------|---|
| data[8] | u16 | data[0]: Channel 0 AD data ... data[7]: Channel 7AD data If unipolar voltage: 0~5V or 0~10V is 0~65535 If bipolar voltage, please take the data as 2's complement, change to i16 first then -5V~+5V or -10V~+10V is -32768 ~ +32767 |

Note:

To read all channels in integral

Start integral mode by EX94421_AD_integral_start.

Read all channels by **EX94421_AD_integral_all_read**.

Stop AD integration function by **EX94421_AD_integral_stop**.

- **EX94421 AD integral stop**

Format : u32 status = EX94421_AD_integral_stop(u8 CardID)

Purpose: stop AD integral conversion.

Parameters:

Input:

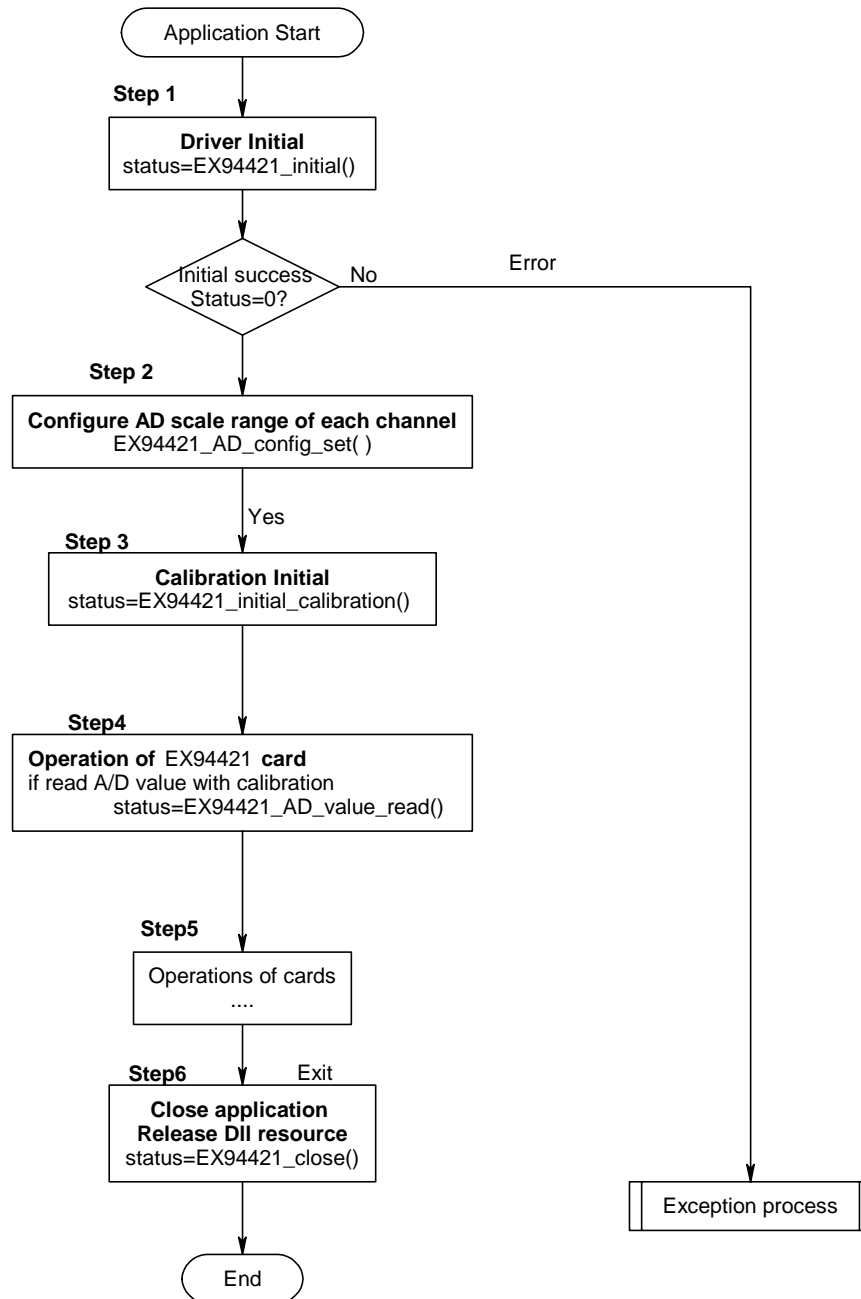
| Name | Type | Description |
|--------|------|----------------------------|
| CardID | u8 | assigned by jumper setting |

3.3 Error conditions

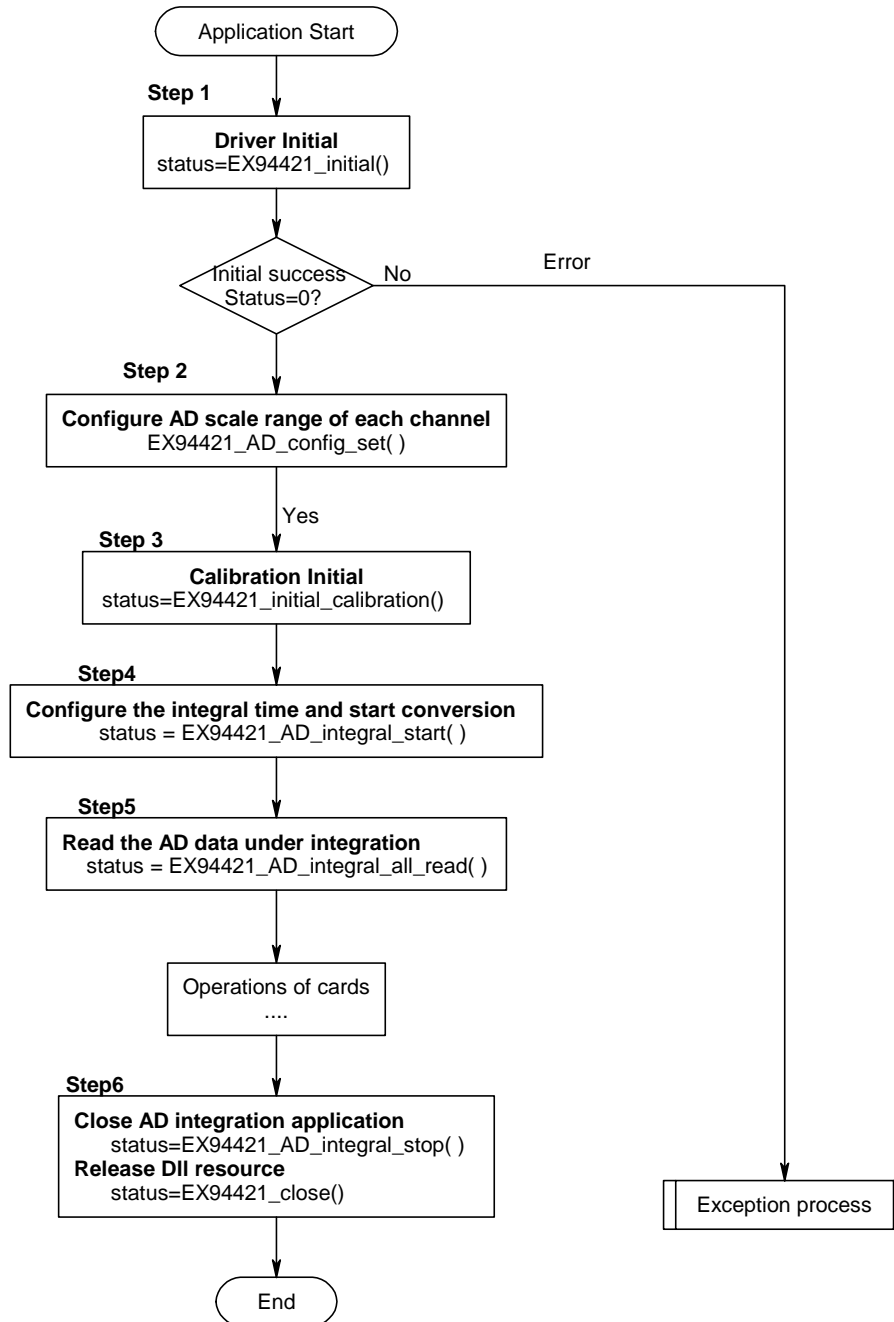
These error types may indicate an internal hardware problem on the board. Error Codes summary contains a detailed listing of the error status returned by EX94421 functions.

4. Flow chart of application implementation

4.1 EX94421 Flow chart of analog I/O application implementation



4.2 EX94421 Flow chart of analog I/O application with embedded integration function



5. Dll list

| | Function Name | Description |
|-----|---------------------------------|---|
| 1. | EX94421_initial() | Card initial. |
| 2. | EX94421_close() | Card Close. |
| 3. | EX94421_info() | Read Card Address. |
| 4. | EX94421_AD_config_set() | Set AD config. |
| 5. | EX94421_AD_config_read() | Read AD config. |
| 6. | EX94421_AD_value_read() | Read AD value. |
| 7. | EX94421_AD_data_read() | Read AD data value. |
| 8. | EX94421_AD_integral_start() | start AD conversion with integral constant |
| 9. | EX94421_AD_integral_all_read() | read port integral result of AD conversion data |
| 10. | EX94421_AD_integral_stop() | stop AD integral conversion |

6. EX94421 Error codes summary

6.1 EX94421 Error codes table

| Error Code | Symbolic Name | Description |
|------------|-------------------------|--|
| 0 | DRV_NO_ERROR | Success, No error. |
| 2 | DRV_INIT_ERROR | Driver initial error |
| 3 | DRV_UNLOCK_ERROR | Security unlock failure |
| 4 | DRV_LOCK_COUNTER_ERROR | Dead lock, unlock failure more than 10 times |
| 5 | SDRV_SET_SECURITY_ERROR | Password overwrite error |
| 100 | DEVICE_RW_ERROR | Device Read/Write error |
| 101 | DRV_NO_CARD | No EX94421 card on the system. |
| 102 | DRV_DUPLICATE_ID | EX94421 CardID duplicate error. |
| 104 | DRV_PAR_ERROR | Bad parameter or illegal parameter |
| 300 | DIO_ID_ERROR | Function input parameter error. CardID setting error, CardID doesn't match the DIP/ROTARY SW setting |
| 301 | AIO_MODE_ERROR | Mode parameter error. Parameter out of range. |
| 302 | AIO_CHANNEL_ERROR | Channel parameter error. Parameter out of range. |
| 305 | AIO_CONVERSION_ERROR | Conversion time over. Maybe no hardware or bad hardware. |
| 306 | AIO_CONVERSION_BUSY | A/D is busy in conversion |
| 400 | AIO_PORT_ERROR | Port parameter error. Parameter out of range. |
| 401 | AIO_STATE_ERROR | State parameter error. Parameter out of range. |
| 402 | AIO_POINT_ERROR | Point parameter error. Parameter out of range. |