Prolin API Programming Guide

V 2.1.1

PAX Computer Technology(Shenzhen)Co.,Ltd.

Revision History

Date	Version	Note	Author
2012-08-29	V1.0.0	Translated from Chinese standard version of ‘Prolin API Programming Guide v1.0.0’.	Prolin Team
2012-11-19	V1.0.1	Modified the interfaces.	Prolin Team
2012-12-26	V1.0.2	1. Added the return code list in the System function; 2. Added a new interface OsVerifySignExternal(); 3. Added the WIFI module; 4. Added the Register table in Appendix	Prolin Team
2013-02-20	V1.0.3	1. Added descriptions in OsOpenFont ().	Prolin Team
2013-03-06	V1.0.4	1. Modified the description of OsModemOpen(); 2. Added two return values -3219 and -3220 in Modem; 3. Added the instruction of DetectDailTone; 4. Added a new function OsModemSwitchPower(); 5. Modified the parameter description of OsPrnOpen(), it does not support the png format; 6. Modified the sci_get_fd ().	Prolin Team
2013-04-17	V1.0.5	1. Modified the 14.4.1 open() node; 2. Updated the time setting code, Modify the “pow-hwclock -w” to “pow-hwclock -w -u”; 3. Updated the fifth term of OsWlInit() instruction; when the return value is ERR_WL_NOSIM (without SIM card), application can use some functions without SIM card. 4. Updated the instruction of the OsCheckBattery ().	Prolin Team
2013-05-17	V1.0.6	1. Modified the description of ‘Timer’. 2. Added description of ‘Delay’. 3. Added description for registry table. 4. Modified the parameter description of Value inOsRegGetValue ().	Prolin Team

		5. Modified the parameter description of ShaOut inOsSHA (). 6. Updated the description of GUI. 7. Added '1200, V22' and'2400, FC' to the parts of synchronous variable for MODEM.	
2013-08-09	V1.0.7	1. Modified the Registry table. 2. Modified the data structure of Font. 3. Updated the OsCheckBattery() 4. Updated the chapter 15 ICC Reader and chapter 16 RF Reader.	Prolin Team
2013-10-22	V1.0.8	1. Added 4.11 Save the crash report for system function. 2. Modified the brightness level to [0~10] in the chapter of LCD.In particular , 0 indicates closing the backlight 3. Updated the key value definitions in the chapter of Keyboard.	Prolin Team
2013-10-31	V1.0.9	1. Updated the chapter of System function 2. Modified the OsCodeConvert() in the character conversion. 3. Added new interfaces OsPortReset() and OsPortCheckTx() in the Communication chapter. 4. Updated the Audio chapter, add a new interface OsPlayWave().	Prolin Team
2013-11-20	V2.0.0	1. Added the KeyVarType parameter associated with the description of 0x02 2. Modified the parameters value ranges in several chapters associated with PED. 3. Modified the description of parameter ucATQ0 in OsPiccAntiSel (). 4. Deleted OsPiccGetParam() and OsPiccSetParam(). 5. Updated the instruction of OsRegGetValue(). 6. Added notes of OsPortOpen(). 7. Updated instructions of OsSysSleep() 8. Updated the Return code list in chapter Network Configuration. 9. Added instruction of OsNetDns().	Prolin Team
2014-2-25	V2.0.1	1. Modified the instruction of OsWlSelSim().	Prolin Team

		2. Added a return value forOsMsrOpen(). 3. Added new interfaces OsWlLoginEx(), OsMount(), OsUmount(). 4. Add chapter 26 Barcode. 5. Add AES functions. 6. Updated the Appendix 4. 7. Modified the parameter Name in the OsInstallFile(). 8. Added an error code “ERR_APP_MODE” for theOsInstallFile(). 9. Added a new interface OsCheckPowerSupply(). 10. Since Prolin2.4 upgrade, deleted the unsuccessful code in chapter 7 LCD.	
2014-3-4	V2.0.2	1. Updated the OsSysSleep(). 2. Updated the WIFI module.	Prolin Team
2014-3-24	V2.0.3	1. Modified the WIFI module.	Prolin Team
2014-4-16	V2.0.4	1. Updated OsWifiConnect() and OsWifiCheck(). 2. Added a new interface OsSysSleepEx(). 3. Added new interface OsReboot() and OsPowerOff(). 4. Removed the MS-MOVE in parameter MountFlags.	Prolin Team
2014-6-3	V2.0.5	1. Modified the instruction of OsPrnSetIndent(). 2. Modified the functionality description of OsModemCheck(). 3. Modified the description of the parameter TimeoutMS in OsPortRecv(). 4. Modified the value range of the parameter Volume in OsPlayWave(). 5. Modified the OsMifareOperate(). 6. Listed the corresponding relation between device node and serial port. 7. Updated the instructions of OsWlSwitchSleep() and OsWifiSwitchPower().	Prolin Team
2014-07-10	V2.0.6	1. Updated the instructions of OsLog(). 2. Updated the return value of OsPedSetInterval(). 3. Added a new interface	Prolin Team

		OsPedCancelPinEntry(). 4. Added return values for OsVerifySign() and OsVerifySignExternal(). 5. Updated the instruction of OsCheckBattery(). 6. Updated the Appendix 3 and Appendix 4.	
2014-10-09	V2.0.7	1. Updated the return value of OsWlLogin() and add the corresponding new instruction. 2. Modified int OsWifiClose(void) to void OsWifiClose(void); 3. Modified the nodes of LCD, keypad, touch screen devices.	Prolin Team
2014-11-26	V2.0.8	1. Modified the instrunction of the OsRunApp(). 2. Added the U disk file format limitation in OsMount(). 3. Added the specification about S920 in parameter 'Channel' in OsPortOpen(). 4. Added the instruction of OsNetPing(). 5. Modified the instruction of OsNetDns(). 6. Modified the instruction of OsNetSetConfig(). 7. Added the instruction of OsNetStartDhcp(). 8. Modified the function and added a new return value for OsNetSetRoute(). 9. Modified the function, return values and instruction of OsNetGetRoute(). 10. Modified the instruction of OsPppoeLogin(). 11. Modified the instruction of OsWlLogin(). 12. Modified the instruction of OsWlLoginEx(). 13. Added WAVE file sampling frequency limitation in OsPlayWave(). 14. Added new instructions for S920 models in appendix 4.	Prolin Team
2014-12-18	V2.0.9	1. Added a new function OsNetPingEx() to check the the status of connection.	Prolin

		2. Added some return code in 2.2 general return code. 3. Added a return value and instruction in OsPrnOpen(). 4. Added some return values and instruction in OsWlLock(). 5. Added a new return value and instruction in OsWlLogout(). 6. Modified the description of the return value in OsCheckBattery(). 7. Added a new instruction in OsNetSetRoute(). 8. Added a new system upgrade block with two functions OsFirmwareGetVersion() and OsFirmwareUpgrade() in the chapter of System Function.	Team
2015-02-06	V2.1.0	1. Added a new return value ERR_APP_NOT_EXIST in OsRunApp(). 2. Modified the instruction of OsPedSetInterval(). 3. Updated the parameter DataIn in OsPedUpdatePinBlock(). 4. Modified the instruction of OsPedDesDukpt(). 5. Modified the parameter DataInLen in OsPedRsaRecover(). 6. Modified the Appendix 1. 7. Added a new return value ERR_WL_NOREG in OsWlInit() function indicating registering GPRS network failed. 8. Added a new note in wifi module like this: At present, Prolin WIFI only supports module with keyword ro.fac.wifi is “RS9110-N-11-02” or “01”. 9. Added a new note in OsPortOpen() function: calling this function will functions of close software flow control and hardware flow control. 10. Added two lines of code in set the configuration parameters of communication port.	Prolin Team

2015-04-13	V2.1.1	1. Added the instruction of LCD size and rotation method of different POS models in Appendix 4. 2. Added a new return value ERR_BATTERY_ABSENT in function OsWifiOpen() and its corresponding instruction.	

Contents

Table List

1 Introduction

1.1 Purpose

This document was previously named as Prolin API Programming Guide.

Prolin SDK supports necessary tools and resources to create Prolin applications, they are different from the application that running on the background of Prolin system. Based on the Prolin OS devices, they can run as an independent executive program.

Local applications can access all features of Prolin OSsave data in the local file system and can even communicate with various installed programs through custom URL. It uses the default or customized GUI framework to develop the local GUI application program for Prolin OS and installs GUI system package. This framework not only provides a lot of default behaviors but also provides some connections. Developers can customize and extend its behavior through these connections.

1.2 Readers

This document is primarily targeted for Prolin OS developers, who are expected to create Prolin applications. The purpose is to introduce the framework of Prolin application program; demonstrate some of the key customization points in GUI and other significant frameworks; and provide programming aid to the API interfaces, which support driver control to the Prolin OS hardware platform. It will also provide guidance to design.

The interface provided by Prolin is based on Linux system calls or POSIX interface. Considering the compatibility requirements of the PaxME OS and applications, it will encapsulate a set of OSAL interface which begins with the prefix “Os”. The access of other devices and system functions will provide the demo code to guide developers how to use the POSIX or system library to program.

For details, refer to the following document.

In this document, the interface that begins with the prefix “Os” has been defined in osal.h of SDK, unless otherwise specified.

1.3 Prerequisite

The prerequisites for this document are as follows:

- Basic understanding of Linux.
- Basic information about processes, threads and Linux system functions and their roles in application development.
- Familiar with memory management and process management.
- Familiar with Linux input subsystem and frame buffer.

For the Linux user, you should use Linux kernel version greater than 2.6.22 to run the Prolin SDK. For the Windows user, you should use Windows XP or higher to run the Prolin SDK. You can get the Prolin SDK from PAX support team.

1.4 Related Documents

- Prolin Terminal Manager Operating Guide
- Prolin SDK Tutorial
- Prolin GUI Programming Guide
- Prolin App Development Guide
- Prolin PCKit Operating Guide

1.5 Abbreviation

Table 1 Abbreviation

Abbreviation	Description
API	Application Programming Interface
CDPD	Cellular Digital Packet Data
CHAP	Challenge Handshake Authentication Protocol
DHCP	Dynamic Host Configuration Protocol
DUKPT	Derived unique key per transaction
EMV	Europay, MasterCard, Visa EMV is a global standard for credit and debit payment cards based on chip card technology

GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
IC	Integrated circuit
IC Card	Integrated Circuit Card
IPCP	IP Control Protocol
KSN	Key Serial Number
KCV	Validation of the key plaintext.
LCP	Link Control Protocol
LRC	Longitude Redundancy Check
MODEM	Modulator-demodulator.
MSR	Magnetic Stripe Reader
NCP	Network Control Protocol
PAP	Password Authentication Protocol
PCD	Proximity Coupling Device
PED	PIN Entry Device
PICC	Proximity Integrated Circuit Card
POS	Point of Sale
PPP	Point-to-Point Protocol
PUK	Public Key
SAM	Security Authentication Module
SGSN	Serving GPRS Support Node
SIM	Subscriber Identity Module
SMS	Short Message Service
SSL	Secure Sockets Layer
TWK	Transaction working key

1.6 Document Conventions

NOTE

【Used for labeling common notes.】

CAUTION

【Used for reminding the audience some place may have to pay attention to, which may lead to exceptions or errors.】

【Used for warning the audience some place must be very careful, which may lead to very serious errors or damages.】

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2 Return Code and Parameter

2.1 Return code classification

List the types and values of the return code which appeared in this document.

Table 2 Return code classification List

Type	Value(Decimal)	Description
General return code	-1000~-1999	As general return code for API.
System function	-2200~-2299	
Power Management	-2300~-2399	
Encryption and Decryption	-2400~-2499	
Font library	-2500~-2599	
LED display	-2600~-2699	
MSR	-2700~-2799	
ICC Reader	-2800~-2899	
RF Reader	-2900~-2999	
Communication port	-3000~-3099	
MODEM	-3100~-3299	
IP Network Configuration	-3300~-3399	
PED	-3800~-3899	

2.2 General return code

Table 3 General return code list

Macro	Value	Description
RET_OK	0	Success
ERR_INVALID_HANDLE	-1000	Invalid handle
ERR_TIME_OUT	-1001	Timeout
ERR_APP_NOT_EXIST	-1002	Application does not exists
ERR_INVALID_PARAM	-1003	Invalid Parameters
ERR_DEV_NOT_EXIST	-1004	Device not exists.
ERR_DEV_BUSY	-1005	Device is busy.
ERR_DEV_NOT_OPEN	-1006	Device is not open.
ERR_ACCESS_DENY	-1007	Access denied.
ERR_FONT_NOT_EXIST	-1008	Font does not exist.
ERR_FILE_FORMAT	-1009	File format error.
ERR_USER_CANCEL	-1010	User cancels.
ERR_NO_PORT	-1011	No communication port available.
ERR_NOT_CONNECT	-1012	Not Connected
ERR_MEM_FAULT	-1013	Memory fault.
ERR_SYS_BAD	-1014	System configuration error.
ERR_SYS_NOT_SUPPORT	-1015	System does not support this function.
ERR_STR_LEN	-1016	Character string is too long.
ERR_TOO_MANY_HANDLE	-1017	Too many handle.
ERR_APP_MODE	-1018	Mode error.
ERR_FILE_NOT_EXIST	-1019	File does not exist.
ERR_TS_DISABLE	-1020	Touch screen is not open.

ERR_FONT_CODE	-1021	Character encoding error
ERR_VERSION_TOO_LOW	-1022	The version number is too low
ERR_BATTERY_ABSENT	-1023	The batter is absent

2.3 Parameter Specification

API parameters are divided into input parameters and output parameters. The type of the parameters has been labeled in the detailed API specification.

All string input and output parameters end with "\x00", and String parameters must indicate the length limit.

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3 Thread

Prolin supports multithread development. The platform provides standard POSIX thread library (pthread) for developers to use.

The pthread header file is located in the installation directory of Prolin SDK:

tool chains\arm-linux\arm-softfloat-linux-gnu\include\pthread.h

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4 System Function

4.1 Return code list

Table 4 System function return code list

Macro	Value	Description
ERR_FILE_NOT_FOUND	-2201	File can’t be found.
ERR_VERIFY_SIGN_FAIL	-2204	Verify signature failed.
ERR_NO_SPACE	-2205	No enough system space.
ERR_NEED_ADMIN	-2207	Permission denied. (Need higher permissions.)

Table 5 Macro definitions of file types

Macro	Value	Description
FILE_TYPE_APP	1	Application package
FILE_TYPE_APP_PARAM	2	Application data file
FILE_TYPE_SYS_LIB	3	System dynamic library file
FILE_TYPE_PUB_KEY	4	User public key file

FILE_TYPE_AUP	5	Application upgrade package

4.2 Data Definition

LOG_T(Enumerate LOG types):

LOG_T:

```
typedef enum{
        LOG_DEBUG,      //Display debugging information
        LOG_INFO,       // Display prompt information
        LOG_WARN,         // Display warning information
        LOG_ERROR,      // Display error information
} LOG_T;
```

ST_TIME (structure of time)

ST_TIME:

```
typedef struct{
int Year;                      //year 1970– 2037
int Month;                   //month 1 –12
int Day;                       //day 1 –31
        int Hour;              //hour 0 – 23
        int Minute;           //minute 0 –59
        int Second;            //second 0 –59
        int DayOfWeek;       //Monday–Sunday（Only effective for reading time）
} ST_TIME;
```

ST_TIMER (structure of timer)

ST_TIMER:

```
typedef struct{
unsigned long Start;
unsigned long Stop;
unsigned long TimeLeft;
} ST_TIMER;
```

ST_APP_INFO (structure of application information)

ST_APP_INFO：

```
typedef struct{
        char Id[32];
        char Name[64];
        char Bin[64];
        char Artwork[64];
        char Desc[64];
        char Vender[32];
        char Version[32] ;
} ST_APP_INFO;
```

4.3 Timeset

4.3.1 OsSetTime

Prototype	**int OsSetTime(const ST_TIME *Time);**	
Function	Set the system time, the week value will not work.	
Parameters	Time 【Input】	Time structure
Return	RET_OK	Success
	ERR_NEED_ADMIN	Need higher permissions.
	ERR_INVALID_PARAM	Invalid parameter
Instruction	Only the main application has permission to set the time, otherwise, it will return ERR_NEED_ADMIN.	

4.3.2 OsGetTime

Prototype	**void OsGetTime(ST_TIME *Time);**	
Function	Get the system time.	
Parameters	Time 【Output】	Time structure
Return	None	
Instruction		

4.4 Timer

4.4.1 OsTimerSet

Prototype	**int OsTimerSet(ST_TIMER *Timer, unsigned long Ms);**	
Function	Set the timer.	
Parameters	Timer 【Output】	Timer
	Ms 【Input】	Time【unit:ms】
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
Instruction		

4.4.2 OsTimerCheck

Prototype	**unsigned long OsTimerCheck(ST_TIMER *Timer);**	
Function	Check the remaining time of a specified time.	
Parameters	Timer 【Input】	Timer
Return	>=0	The remaining time.【unit:ms】
	ERR_INVALID_PARAM	Invalid parameter
Instruction		

4.5 Delay

4.5.1 OsSleep

Prototype	**voidOsSleep(unsigned int Ms);**	
Function	System delay, the delay process will not be interrupted by signal.	
Parameters	Ms 【Input】	The delay time【unit:ms】
Return	None	
Instruction		

4.6 Thread

To implement the thread management, please refer to the following code.

Example:

```
#include <pthread.h>

static pthread_t ntid;

static void *thread_fn(void *arg)

{
   printf("This is child thread\n");
   return ((void *)0);
}


int main()
{
   printf("This is main thread\n");

   if(pthread_create(&ntid, NULL, thread_fn, NULL) != 0)
        printf("can't create thread\n");

   sleep(5);
   return 0;
}
```

4.7 Log

4.7.1 OsLogSetTag

Prototype	**void OsLogSetTag(const char *Tag);**	
Function	Set the LOG tag.	
Parameters	Tag【Input】	LOG information tag
Return	None	
Instruction	Set the LOG tag, and the default tag is null. Suggest setting Tag to be an application name. It supports up to 32 bytes, when - it is greater than 32 bytes, just use the first 32 bytes. When the Tag is an empty string or NULL, the OsLog () will not work.	

4.7.2 OsLog

Prototype	**int OsLog(LOG_T Prio,**

	const char *fmt, **…);**	
Function	Record the LOG information.	
Parameters	Prio【Input】	LOG type
	fmt 【Input】	Format of log information
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
Instruction	If you forget to call OsLogSetTag(), the OsLog() function won't work.	

4.8 Get the count value

4.8.1 OsGetTickCount

Prototype	**unsigned long OsGetTickCount(void);**	
Function	Get the system count value.	
Parameters	None	
Return	>0	Count value.【unit:ms】
Instruction	The value represents the time from the boot to the present time.	

4.9 Get Appliaction information

4.9.1 OsGetAppInfo

Prototype	**int OsGetAppInfo(ST_APP_INFO AppInfo[],** **int InfoCnt);**	
Function	Get the application information.	
Parameters	AppInfo 【Output】	Array of AppInfo structure.
	InfoCnt 【Input】	The number of Apps that can be stored in the array.
Return	>=0	Returns the number of obtained App information
	ERR_NEED_ADMIN	Need higher permission
	ERR_INVALID_PARAM	Invalid parameter
Instruction	1. Only the main application has permission to get the information. 2. When the number of existing applications is more than InfoCnt, the InfoCnt shall prevail.	

4.10 Buzzer

4.10.1 OsBeep

Prototype	**void OsBeep(int ToneType, int DurationMs);**	
Function	The buzzer.	
Parameters	ToneType 【Input】	Tone type. The value ranges from 1 to 7.
	DurationMs 【Input】	Duration: the value ranges from 10 to 10000.【unit:ms】
Return	None	
Instruction	If ToneType<1, set it to 1, if ToneType>7, set it as 7. If DurationMs<10, set it to 10, if DurationMs>10000, set it to 10000.	

4.11 Run Application

4.11.1 OsRunApp

Prototype	**int OsRunApp(char *AppId, char **Argv, void *Data, RUNAPP_CB CbOut, RUNAPP_CB CbErr);**	
Function	Switch to a specified sub-application.	
Parameters	AppId 【Input】	sub-application ID
	Argv 【Input】	Argument list, it can be NULL if we do not need that.
	Data 【Input】	Custom data, it will be passed to CbOut() and CbErr() to call back.
	CbOut 【Input】	Callback function of the standard output information.
	CbErr 【Input】	Callback functions of the standard error information.
Return	RET_OK	Success
	ERR_APP_NOT_EXIST	Sub-application does not exist.
	ERR_ACCESS_DENY	Access denied
	ERR_APP_MODE	Mode Error
	ERR_INVALID_PARAM	Invalid parameter
	ERR_NEED_ADMIN	Need higher permission.
Instruction	1. Only the main application has permission to switch application, otherwise, it will return ERR_NEED_ADMIN.	

	2. Switch to a specified sub-application, but switching to the main application is not allowed, if "MAINAPP" is passed in to AppId, ERR_INVALID_PARAM will be returned. 3. This will output the standard output information and standard error information of the sub-application to CbOut () and CbErr (), respectively. For the multi-line standard output and standard error, the callback function will be called multiple times.The callback function is defined as follows: **typedef void (*RUNAPP_CB)(char *appid, char *str, void *data);**

4.12 Set and Read the registry table

OsGetTerminalInfo() and OsReadSn() which applied to Prolin 2.3 have been deleted, and the related functions can be implemented by calling OsRegGetValue().

4.12.1 OsRegSetValue

Prototype	**int OsRegSetValue(const char *Key, const char *Value);**	
Function	Set system parameters.	
Parameters	Key 【Input】	System configuration name, it needs ending with'\0'.
	Value 【Input】	The parameter value cannot be null and should be less than 64 bytes. It needs ending with '\0'.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid Parameters
	ERR_NEED_ADMIN	Need higher permissions.
Instruction	The system configuration name can only be set beginning with "persist.sys." For example, "persist.sys.app0.pic".	

4.12.2 OsRegGetValue

Prototype	**int OsRegGetValue(const char *Key, char *Value);**	
Function	Read system parameters.	
Parameters	Key 【Input】	System configuration name, it needs ending with'\0'.
	Value 【Output】	The parameter value cannot be null and it must be more than 64 bytes.
Return	>=0	Read the string length
	ERR_INVALID_PARAM	Invalid Parameters

Instruction	The system configuration name can only be set beginning with “ro.fac.” or “persist.sys.” About the “ro.fac.”, users can refer to registry table. If the query parameter does not exist or the parameter value is empty, it’ll return 0 and the output parameter Value will be “”.

4.13 Install and uninstall files

4.13.1 OsInstallFile

Prototype	**int OsInstallFile(const char *Name, const char *FileName,int FileType);**	
Function	Install application and system files.	
Parameters	Name 【Input】	▪ When FileType is FILE_TYPE_PUB_KEY, assign the value from "uspuk0" to "uspuk8" to Name and it represents the user public key ranging from 0 to 8. ▪ When FileType is FILE_TYPE_APP_PARAM N Name is the corresponding ID of the parameter files. ▪ When FileType is the other type, Name is invalid, and it can be NULL.
	FileName 【Input】	The filename which needs to be installed.
	FileType	▪ FILE_TYPE_APP (the application package) ▪ FILE_TYPE_APP_PARAM (the application data file) ▪ FILE_TYPE_SYS_LIB (the dynamic library file) ▪ FILE_TYPE_PUB_KEY (the user public key file) ▪ FILE_TYPE_AUP(the application update package)
Return	RET_OK	Success
	ERR_PUK_NOT_EXIST	The specified user public key does not exist.
	ERR_FILE_NOT_FOUND	FileName does not exist.
	ERR_FILE_FORMAT	FileName format error.
	ERR_INVALID_PARAM	Invalid Parameters
	ERR_VERIFY_SIGN_FAIL	Signature verification failed.
	ERR_APP_MODE	Mode error
Instruction	Name will be valid only when the FileType is FILE_TYPE_PUB_KEY or FILE_TYPE_APP_PARAM, other types are invalid.	

4.13.2 OsUninstallFile

Prototype	**int OsUninstallFile(const char *AppName, int FileType);**	
Function	Uninstall applications and system files.	
Parameters	AppName【Input】	▪ When the FileType is FILE_TYPE_APP, it means AppName is the Application ID which needs to be deleted. ▪ When the FileType is FILE_TYPE_SYS_LIB, AppName is the name of system library.
	FileType	▪ FILE_TYPE_APP (Application package, the application has installed all the files.) ▪ FILE_TYPE_SYS_LIB (System library file)
Return	RET_OK	Success
	ERR_APP_NOT_EXIST	The application specified by AppName does not exist.
	ERR_FONT_NOT_EXIST	The font library does not exist.
Instruction	This function is only used for unloading application and parts of system files.	

CAUTION

After calling this function to uninstall all files that need to uninstall, the application will prompt the user to restart the terminal to complete the uninstallation.

4.14 System firmware upgrade

4.14.1 OsFirmwareGetVersion

Prototype	**int OsFirmwareGetVersion(char *Version, int Size);**	
Function	Acquire system firmware version.	
Parameters	Version【output】	Pointer to the buffer, 64 bytes is recommended for the buffer length.
	Size 【Input】	Buffer length
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
Instruction	1. The acquired version information is MAIN_VERSION-SVN_VERSION Take "2.6.26-r1789" as an example, MAIN_VERSION is"2.6.26" and SVN_VERSION is "r1789". 2. The user can decide whether the firmware needs upgrading by judging the SVN_VERSION.	

4.14.2 OsFirmwareUpgrade

Prototype	**int OsFirmwareUpgrade(const char *FwFileName);**	
Function	Upgrade system firmware.	
Parameters	FwFileName 【Input】	Firmware filename, an example of filename format could be: prolin-2.4.26-CCV-r1918.zip
Return	RET_OK	Update succeeded
	RR_FILE_NOT_FOUND	'FwFileName' file doesn't exist
	ERR_VERSIN_TOO_LOW	System package version is too low
	ERR_VERIFY_SIGN_FAIL	Verify signature failed
	ERR_AP_MODE	Application mode error
	ERR_INVALID_PARAM	Invalid parameter
Instruction	1. Only the main application gets the permission to upgrade the system firmware. 2. The function will be obstructed during the upgrade process, if an interface prompt is needed, then it has to be done by starting another process. 3. The power should never be cut off during the upgrade process, otherwise the device won't be able to run again. 4. The upgrade will only take effect after reboot.	

4.15 Verify signature

The Prolin provides a function to verify the file signature. Use this interface to verify the signature before using the files.

4.15.1 OsVerifySign

Prototype	**int OsVerifySign(const char *FileName, int PUKType);**	
Function	Verify the file signature specified by FileName to see whether it is legal or not, the signature data is included in the file.	
Parameters	FileName 【Input】	The file name which contains the path.
	PUKType【Input】	▪ **PUK_TYPE_M** The public key of manufacturers. It is used to do the signature verification for firmware released by manufacturer. ▪ **PUK_TYPE_US_PUK** The public key of user signature certificate, it is used to do the signature verification for the public key certificate. ▪ **PUK_TYPE_USER0~PUK_TYPE_USER8** The public key of users, it is used to do the signature

		verification for user application.
Return	RET_OK ERR_VERIFY_SIGN_FAIL ERR_FILE_NOT_EXIST ERR_DEV_BUSY ERR_INVALID_PARAM	Success Illegal signature. The file does not exist. Device is busy. Invalid parameter
Instruction	1. This function is only used for the application to verify the application parameter file, for example, to verify the root certificate defined by the application. 2. In order to avoid validation repetition, it should not use this function to verify the legitimacy of the file until the file is installed. (System will verify automatically in OsInstallFile()).	

4.15.2 OsVerifySignExternal

Prototype	**int OsVerifySignExternal(const char *FileName, const void *SignData, int PUKType);**	
Function	Verify the file signature specified by FileName to see whether it is legal or not. The file does not include the signature data.	
Parameters	FileName 【Input】	The file name which contains the path.
	SignData 【Input】	Signature data, it has 284 bytes.
	PUKType【Input】	▪ **PUK_TYPE_M** The public key of Manufacturers. It is used to do the signature verification for firmware released by manufacturer. ▪ **PUK_TYPE_US_PUK** The public key of user signature certificate, it is used to do the signature verification for the public key certificate. ▪ **PUK_TYPE_USER** The public key of users, it is used to do the signature verification for user application.
Return	RET_OK ERR_VERIFY_SIGN_FAIL ERR_FILE_NOT_EXIST ERR_DEV_BUSY ERR_INVALID_PARAM	Success Illegal signature. The file does not exist. Device is busy. Invalid parameter
Instruction	1. This function is only used for the application to verify the application parameter file, for example, to verify the root certificate defined by the application.	

	2. In order to avoid repeating validation, –the user should use this function to verify the legitimacy of the file before installing the file. (System will verify automatically in OsInstallFile ()).

4.16 Get system version

This interface is reserved for future use.

4.16.1 OsGetSysVer

Prototype	**void OsGetSysVer(int VerType, char *Version);**	
Function	Read information of the system version.	
Parameters	VerType	Version types: ▪ TYPE_OS_VER Operating system version ▪ TYPE_OSAL_VERAPI Library version ▪ TYPE_DRIVER_VER Driver version ▪ TYPE_PED_VER built-in PED version ▪ TYPE_MSR_VER MSR version ▪ TYPE_ICC_VER ICC Reader version ▪ TYPE_PCD_VER PCD Reader version ▪ TYPE_EMVL1_VER EMV Level1 version ▪ TYPE_PRINTER_VER Printer version ▪ TYPE _MODEM_VER Modem version ▪ TYPE_ETH_VER Netcard version ▪ TYPE_GPRS_VER GPRS version ▪ TYPE_CDMA_VER CDMA version ▪ TYPE_TD_VER TD version ▪ TYPE_WIFI_VER WIFI version ▪ TYPE_BT_VER Bluetooth version
	Version【Output】	Version information. (Ending with “\0”, and length <=31 bytes)
Return	None	
Instruction	1. If Version[0] is equal to 0x00,it means the corresponding module does not exist, 2. The buffer size of version must be greater than31 bytes.	

4.17 Determine whether on the base

Prolin can determine whether the handset is on the base or not. Since the S series doesn’t have any bases, so it can’t support this function.

4.17.1 OsOnBase

Prototype	**int OsOnBase(void);**	
Function	Determines whether the handset is on the base.	
Parameters	None	
Return	1	yes
	0	no
Instruction	This function is only applicable to handset with base.	

4.18 Save the crash report

Prolin supports monitoring program state. Once the program crashes, it will generate crash report in the directory'/data/tombstones' after calling this function.

4.18.1 OsSaveCrashReport

Prototype	**void OsSaveCrashReport(ing sig);**	
Function	Save the crash report.	
Parameters	Sig	Signal value
Return	None	

Instruction	▪ **Method one**
	Through the function signal(SIG_XXX, OsSaveCrashReport); OsSaveCrashReport will be registered as signal handler, for example:
	signal(SIGILL, OsSaveCrashReport);
	signal(SIGABRT, OsSaveCrashReport);
	signal(SIGBUS, OsSaveCrashReport);
	signal(SIGFPE, OsSaveCrashReport);
	signal(SIGSEGV, OsSaveCrashReport);
	signal(SIGSTKFLT, OsSaveCrashReport);
	▪ **Method two**
	During the signal handler process, call OsSaveCrashReport (sig) to save the error message. For example:
	int mysighandler(int sig)
	{
	do_something();
	OsSaveCrashReport(sig);
	}
	The recommended signals are SIGILL, SIGABRT, SIGBUS, SIGFPE, SIGSEGV and SIGSTKFLT.
	After calling this function, it will ignore the signal that corresponds to sig. That is, it calls the signal (sig, SIG_IGN) in function OsSaveCrashReport ().
	In Terminal Manager(TM), it can export the report to U disk.	

4.19 Mount and Unmount the external file system

4.19.1 OsMount

Prototype	**intOsMount(const char *Source, const char *Target, const char *FileSystemType, unsigned long MountFlags, const void *Data);**	
Function	Mount the source file system to the target file system.	
Parameters	Source 【Input】	The file system that needs to be mounted, it is usually a device that locates in /dev/block/directory and the path length cannot exceed 128 bytes.
	Target 【Input】	The target file directory that the file system will mount to must be in the /mnt/ directory-whose length cannot exceed 128 bytes.
	FileSystemType 【Input】	File system type that needs to be mounted- can be signed as vfat“
	MountFlags 【Input】	Mount flag, it can be the combinations of the following flags: ▪ **MS_DIRSYNC:** Synchronize the directory updates. ▪ **MS_MANDLOCK:** Allow the mandatory locks on files. ▪ **MS_NOATIME:** Need not to update the access time. ▪ **MS_NODEV:** Don't allow accessing to device file. ▪ **MS_NODIRATIME:** Don't allow updating the access time on directory. ▪ **MS_NOEXEC:** Don't allow execute programs on the mounted file system. ▪ **MS_NOSUID:** When executing program, do not follow to the set-user-ID and set-group-ID. ▪ **MS_RDONLY:** Specify the file system as read-only. ▪ **MS_RELATIME:** When a file is accessed, if the last access time (atime) is less than or equal to the last modification time (mtime) or last status change time (ctime), then update the last access time (atime) values. ▪ **MS_SILENT:** Stop writing warning information to the system kernel log

		▪ **MS_STRICTATIME:** Always updating the last access time(atime). ▪ **MS_SYNCHRONOUS:** Synchronize the file updates.
	Data【Input】	The user-defined additional data.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
	ERR_STR_LEN	The string is overlength.
	ERR_NEED_ADMIN	Need higher permissions.
Instruction	Only the main application can mount, otherwise it will fail to mount and return ERR_NEED_ADMIN. Note: currently the only supported U disk format is FAT32;	

4.19.2 OsUmount

Prototype	**intOsUmount(const char *Target, int Flags);**	
Function	Unmount the file system.	
Parameters	Target 【Input】	The file system that needs to unmount, it must be in the /mnt/ directory, and the path length cannot exceed128 bytes.
	Flags 【Input】	Unmount flag, it can be combination of the following flags: ▪ **MNT_DETACH:** Lazy umount, the mount point is inaccessible after execution; it will unmount only when the mount point is not busy. ▪ **MNT_EXPIRE:**The mount point is marked as expired ▪ **UMOUNT_NOFOLLOW:** If the target is a symbolic link, do not reduce the reference count.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
	ERR_STR_LEN	The string is overlength.
	ERR_NEED_ADMIN	Need higher permissions.
Instruction	Only the main application can unmount, otherwise it fails to unmount and returns ERR_NEED_ADMIN.	

5 Encryption and Decryption

5.1 Return code list

Table 6 Encryption and decryption return code list

Macro	Value	Description
ERR_DATA_TOO_BIG	-2400	The encrypted data of RSA is greater than module.
ERR_GEN_RANDOM	-2401	Fail to generate random numbers.
ERR_GEN_FAIL	-2402	Fail to generate RSA key pairs.

5.2 Random number

Prolin supports true random number, and provides the application interface to generate true random number.

5.2.1 OsGetRandom

Prototype	**void OsGetRandom(unsigned char *Random, int RandomLen);**	
Function	Read the true random number.	
Parameters	Random【Output】	Storing the pointer of random number.

	RandomLen	Length of random number which needs to be read. (<=4096bytes)
Return	None	
Instruction		

5.3 SHA algorithm

Prolin supports the SHA algorithms, such as SHA-1, SHA-2(SHA-256, SHA-512) and truncates form of the SHA-2(SHA-224, SHA-384).

5.3.1 OsSHA

Prototype	**void OsSHA(int Mode, const void *Data, int DataLen, unsigned char* ShaOut);**	
Function	Calculate the Secure Hash value.	
Parameters	Mode	▪ SHA_TYPE_1 ▪ SHA_TYPE_224 ▪ SHA_TYPE_256 ▪ SHA_TYPE_384 ▪ SHA_TYPE_512
	Data 【Input】	the input data buffer
	DataLen	the input data length
	ShaOut	Output value of SHA, the array should be equal to or more than 64 bytes. The corresponding relations between Mode value and ShaOut length are listed as following: ▪ SHA_TYPE_1 20 ▪ SHA_TYPE_224 28 ▪ SHA_TYPE_256 32 ▪ SHA_TYPE_38 48 ▪ SHA_TYPE_512 64
Return	None	
Instruction	Calculate the hash values of SHA family.	

5.4 DES algorithm

Prolin supports DES & TDES algorithms.

5.4.1 OsDES

Prototype	**void OsDES(const unsigned char *Input, unsigned char *Output, const unsigned char *DesKey, int KeyLen, int Mode);**	
Function	Do DES / TDES encryption and decryption with 8bytes.	
Parameters	Input 【Input】	8-byte input data
	Output【Output】	8-byte output data
	DesKey 【Input】	DES/TDES key
	KeyLen	8, 16 or 24 (bytes)
	Mode	0- Decryption; 1- Encryption.
Return	None	
Instruction	Do the encryption or decryption according to the mode selection. If the parameters are invalid, there will be no operation.	

5.5 AES algorithm

Prolin supports AES algorithm, including AES-128, AES-192, AES-256.

5.5.1 OsAES

Prototype	**void OsAES(const unsigned char *Input, unsigned char *Output, const unsigned char *AesKey, int KeyLen, int Mode);**	
Function	Perform AES encryption and decryption operation.	
Parameters	Input 【Input】	16-byte input data
	Output【Output】	16-byte output data

	AesKey【Input】	Key
	KeyLen	16, 24 or 32 (bytes)
	Mode	0- Decryption; 1- Encryption.
Return	None	
Instruction	This function supports 128, 192 or 256 (bits) AES encryption and decryption. If the parameter is invalid, there will be no any operations.	

5.6 RSAalgorithm

Prolin supports RSA algorithm, including public/private key-pair generation, RSA encryption and RSA decryption. Currently, Prolin supports a maximum length of 2048 bits.

5.6.1 OsRSA

Prototype	**int OsRSA(const unsigned char * Module, int ModulusLen, const unsigned char *Exp, int ExpLen, const unsigned char *DataIn, unsigned char *DataOut);**	
Function	Perform RSA encryption and decryption operation.	
Parameters	Modulus 【Input】	Pointer to the RSA algorithm modulus buffer (n=p*q). In the order of highest to lowest byte.
	ModulusLen	Modulus length(byte)
	Exp 【Input】	Pointer to the exponent buffer in RSA operation. In the order of highest to lowest byte.
	ExpLen	Exponent length.(byte)
	DataIn 【Input】	Pointer to the input data buffer, its length is the same as module.
	DataOut 【Output】	Pointer to the output data buffer, its length is the same as module.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter.

	ERR_DATA_TOO_BIG	ExpLen is bigger than ModulusLen.
Instruction	1. This function performs RSA encryption/decryption operations; encryption and decryption are performed by selecting different keys. If select a private key, such as Modulus, Exp, it will do encryption; or a public key, it will do decryption. 2. This function can perform RSA operation with the length of less than or equal to 2048 bits.	

5.6.2 OsRSAKeyGen

Prototype	**Int OsRSAKeyGen(unsigned char *Modulus, unsigned char *PriExp, int ModulusLen, const unsigned char * PubExp);**	
Function	Generate RSA Key pair.	
Parameters	Modulus 【Output】	The key modulus. (High byte first)
	PriExp 【Output】	Private key exponent. (High byte first)
	ModulusLen	Module length. (It can be 64, 128, and 256 (bytes)).
	PubExp 【Input】	Public key exponent. It only can be:"\x00\x00\x00\x03" or "\x00\x01\x00\x01"
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid Parameters
	ERR_GEN_RANDOM	Fail to generate random data.
	ERR_GEN_FAIL	Fail to generate RSA Key pair.
Instruction	By calling this interface, it will randomly generate a RSA Key pair with a specified exponent and modulus.	

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6 PED

Prolin provides a series of PED interface, including built-in PED, MK / SK, DUKPT, RSA and other related interfaces.

6.1 Return code list

Table 7 PED Return code list

Macro	Value	Description
ERR_PED_NO_KEY	-3801	Key does not exist.
ERR_PED_KEY_IDX_ERR	-3802	Key index error.
ERR_PED_DERIVE_ERR	-3803	Key level error: When key is written, the source key level is lower than the destination level.
ERR_PED_CHECK_KEY_FAIL	-3804	Key verification failed.
ERR_PED_NO_PIN_INPUT	-3805	No PIN input.
ERR_PED_INPUT_CANCEL	-3806	Cancel PIN input
ERR_PED_WAIT_INTERVAL	-3807	Calling function –time is less than the minimum interval.(Calculate PINBLOCK/MAC)
ERR_PED_KCV_MODE_ERR	-3808	KCV mode error.
ERR_PED_KEY_TAG_ERR	-3809	Key tag error, the key can't be used.
ERR_PED_KEY_TYPE_ERR	-3810	Key type error.

ERR_PED_PIN_LEN_ERR	-3811	The input PIN length is not equal to the expected PIN length.
ERR_PED_DSTKEY_IDX_ERR	-3812	Destination key index error.
ERR_PED_SRCKEY_IDX_ERR	-3813	Source key index error.
ERR_PED_KEY_LEN_ERR	-3814	Key length error.
ERR_PED_INPUT_PIN_TIMEOUT	-3815	PIN input timeout.
ERR_PED_NO_ICC	-3816	IC card does not exist.
ERR_PED_ICC_INIT_ERR	-3817	IC card is not initialized.
ERR_PED_GROUP_IDX_ERR	-3818	DUKPT group index error.
ERR_PED_LOCKED	-3819	PED locked.
ERR_PED_NOMORE_BUF	-3820	No free buffer.
ERR_PED_NORMAL_ERR	-3821	PED general error.
ERR_PED_NEED_ADMIN	-3822	Not administration.
ERR_PED_DUKPT_KSN_OVERFLOW	-3823	DUKPT overflow.
ERR_PED_KCV_CHECK_FAIL	-3824	KCV check failed.
ERR_PED_SRCKEY_TYPE_ERR	-3825	Source key type error.
ERR_PED_UNSPT_CMD	-3826	Command does not support.
ERR_PED_ADMIN_ERR	-3827	Administration error
ERR_PED_DOWNLOAD_INACTIVE	-3828	PED download inactive.
ERR_PED_KCV_ODD_CHECK_FAIL	-3829	KCV parity check failed.
ERR_PED_PED_DATA_RW_FAIL	-3830	Read PED data failed.
ERR_PED_ICC_CMD_ERR	-3831	ICC operation failed.
ERR_PED_DUKPT_NEED_INC_KSN	-3832	DUKPT KSN needs to plus 1 first.
ERR_PED_DUKPT_NO_KCV	-3833	NO KCV.
ERR_PED_NO_FREE_FLASH	-3834	PED has not enough space.
ERR_PED_INPUT_CLEAR	-3835	Press [CLEAR] key to exit PIN input.
ERR_PED_INPUT_BYPASS_BYFUNCTION	-3836	Press FN/ATM4 to cancel PIN input.
ERR_PED_NO_PIN_MODE	-3837	PIN input mode is not set.
ERR_PED_DATA_MAC_ERR	-3838	Data MAC check error.
ERR_PED_DATA_CRC_ERR	-3839	Data CRC check error.
ERR_PED_KEY_VALUE_INVALID	-3840	The work key value already exists or does not match the requirements.

6.2 Data Definition

6.2.1 Key type

Table 8 Key Types

Macro	Value	Description
PED_TLK	0x01	Loading Key
PED_TMK	0x02	Master Key
PED_TPK	0x03	PIN Key
PED_TAK	0x04	MAC Key
PED_TDK	0x05	Data Key
PED_TIK	0x10	DUKPT Initial Key
PED_TRK	0x07	MSR Key
PED_TAESK	0x20	AES Key

6.2.2 Display attribute of Asterisk

Table 9 Layout attributes of asterisk

Macro	Value	Description
PED_ASTERISK_ALIGN_LEFT	0	left-aligned
PED_ASTERISK_ALIGN_CENTER	1	center-aligned
PED_ASTERISK_ALIGN_RIGHT	2	right-aligned

Table 10 The color values of asterisk

Macro	Value	Description
RGB(_r, _g, _b)	…	According to the input of three-primary colors to generate color value with 16-bit.

6.3 Data Structure

6.3.1 Structure of RSA key

ST_RSA_KEY
typedef struct{

```
int ModulusLen;                    /*Modulus length(bits) */

unsigned char Modulus[512];        /*Modulus, if the modulus length<512
                                   bytes, store from right, add 0x00 in left. */

int ExponentLen;                   /* ExponentLength (bits) */

unsigned char Exponent [512];      /*When exponent <512 bytes, add 0x00
                                   in left.*/

unsigned char KeyInfo[128];        /* RSA key information */

}ST_RSA_KEY;
```

6.3.2 RSA key structure for verifying the ciphertext IC card PIN

ST_RSA_PINKEY

```
typedef struct{

int ModulusLen;                    /*Modulus length(bits) */

    unsigned char Modulus[256];    /*Modulus of PIN public key*/
    unsigned char Exponent [4];    /* Exponent of PIN public key*/

int IccRandomLen;                  /*Length of random data gets from IC
                                   card*/

unsigned char IccRandom[8];        /*Random data gets from IC card*/

}ST_RSA_PINKEY;
```

6.4 Basic PED

6.4.1 OsPedOpen

Prototype	**int OsPedOpen(void);**	
Function	Open PED device.	
Parameters	None	
Return	RET_OK ERR_DEV_BUSY	Success Device is busy.
Instruction	Other PED series functions can be called only after successfully opening the	

	PED device.

6.4.2 OsPedGetVer

Prototype	**int OsPedGetVer (unsigned char * PedVer);**	
Function	Return PED version.	
Parameters	PedVer 【Output】	PED version, buffer size is 6 bytes.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
Instruction		

6.4.3 OsPedSetInterval

Prototype	**int OsPedSetInterval(unsigned long TpkIntervalMs);**		
Function	Set the minimum interval time between consecutive operations of getting PINBlock.		
Parameters	TpkIntervalMs	= 0	Use the default value(30s)
		<1000	Automatically set to 1000(1s)
		>600000	Automatically set to 600000(10 min)
		=0xffffffff	No change in current settings.
Return	RET_OK	Success	
	ERR_DEV_NOT_OPEN	PED device is not open.	
Instruction	Calculate the interval time of PINBLOCK: It can only be called 4 times within the default time which is 120-second, that is, the default value of TPKIntervalMs is 30-second, after reset by calling this function, it is limited to call 4 times during the 4*TPKIntervalMs time, for example, if the TPKIntervalMs is 20000(ms), then within 80 seconds, it can only be called 4 times. The timing function will restore the default values after switching machines.		

6.4.4 OsPedVerifyPlainPin

Prototype	**int OsPedVerifyPlainPin(int IccSlot,** **const char * ExpPinLen,** **int Mode,**

	unsigned long TimeoutMs, **unsigned char * IccRsp);**	
Function	Verify the offline plaintext PIN Get plaintext PIN. According to card command and card slot number, then sending plaintext PIN BLOCK to card.	
Parameters	IccSlot	ICC slot number, and IccSlot=0.
	ExpPinLen 【Input】	Enumeration of 0-12 Application enumerates all the possible lengths of PIN, and uses ‘,’to separate each length. If it is allowed to input 4 or 6 digits password and confirm without passwords, the string should be set to ‘0, 4, and 6’. 0 means that user can press ‘Enter’ to return without inputting any digits.
	Mode	**0x00:** IC card command mode. Currently supports EMV2000 only.
	TimeoutMs	The timeout of PIN input.【unit:ms】 Maximum is 300000. 0 means no timeout, and the PED doesn’t do the timeout control.
	IccRsp 【Output】	2 bytes Card response code (2 bytes: SWA++SWB)
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .

Instruction	The internal processing is shown as follow:
	1. Prompt cardholder to input PIN;
	2. Prompt cardholder that it is in process;
	3. Convert plaintext PIN to PIN BLOCK form.
	Use OsIccexchange () to do the verification interaction with the card, as follows:
	ST_APDU_REQ apdu_s;
	ST_APDU_RSP apdu_r;
	
	memcpy (apdu_s.cmd, icc_command, 4);
	apdu_s.lc = icc_command[4];
	memcpy (apdu_s.data_in, PINBLOCK,apdu_s.lc);	

	apdu_s.le = 0;
	if (icc_exchange(icc_slot, 0, &apdu_s, &apdu_r))
	    return CMDERR;
	icc_resp[0] = apdu_r.swa;
	icc_resp[1] = apdu_r.swb;

6.4.5 OsPedVerifyCipherPin

Prototype	**int OsPedVerifyCipherPin(int IccSlot,** **const ST_RSA_PINKEY * RsaPinKey,** **const char * ExpPinLen,** **int Mode,** **unsigned long TimeoutMs,** **unsigned char * IccRsp);**	
Function	Verify offline enciphered PIN. Get plaintext PIN, and then use RsaPinKey provided by the application to encrypt plaintext PIN according to EMV standards. After that, according to card command and card slot number provided by application, send plaintext PIN BLOCK to card.	
Parameters	IccSlot	ICC slot number, Iccslot=0.
	RsaPinKey【Input】	Encrypt the data structure.
	ExpPinLen【Input】	Application enumerates all the possible lengths of PIN, and uses the ‘,’to separate each length. If it is allowed to input 4 or 6 digits, confirm without passwords, thus, the string should be set to‘0, 4, 6’. 0 means that user can press ‘Enter’ to return without inputting any digits.
	Mode	0x00, currently supports EMV2000only.
	TimeoutMs	The timeout of PIN input [ms] Maximum is 300000. 0 means no timeout, and the PED doesn’t do the timeout control.
	IccRsp【Output】	2 bytes Card response code (2 bytes: SWA+SWB)
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.

	ERR_INVALID_PARAM Invalid parameter. Others Refer to the PED Return code list .
Instruction	Encryption algorithm: Use the public key, and apply RSA functions to the following data listed in the table to get enciphered PIN. **Name** | **Length** | **Description** | **Format** Head of Data | 1 | Hex. The value is ‘7F’ | b PIN Block | 8 | PINBLOCK | b unpredictable IC card random data | 8 | The random number got from card, and it is provided in RSA_PINKEY, | b Random padding bytes | NIC–17 | the padding data got from the terminal application, it is provided in RSA_PINKEY, | b

Note	1. Prompt message for PIN input;
	2. Prompt cardholder that it is in process;
	3. Convert plaintext PIN to PIN BLOCK;
	4. Generate data, used for encryption(listed in above table)
	5. Use public key, and apply RSA functions to encryption data which is generated in step4, then getting Enciphered PIN.
	Use OsIccExchange () to send verification command to card, as follows:
	ST_APDU_REQ apdu_s;
	ST_APDU_RSP apdu_r;
	memcpy (apdu_s.cmd, icc_command, 4);
	apdu_s.LC = icc_command[4];
	memcpy (apdu_s.data_in, EncipheredPIN, apdu_s.LC);
	apdu_s.LE = 0;
	if (OsIccExchange(icc_slot, 0, &apdu_s, &apdu_r))
	return ERR_PED_ICC_CMD_ERR;
	icc_resp[0] = apdu_r.SWA;
	icc_resp[1] = apdu_r.SWB;

6.4.6 OsPedEraseKeys

Prototype	**int OsPedEraseKeys(void);**	
Function	Clear all key information in PED.	
Parameters	None	
Return	RET_OK	Success.

	ERR_DEV_NOT_OPEN	PED device is not open.
	Others	Refer to the PED Return code list .
Instruction		

6.4.7 OsPedSetFunctionKey

Prototype	**int OsPedSetFunctionKey (int KeyFlag);**	
Function	Set some functions of function key. When PED is power on, the default function of CLEAR button is to clear input PIN. Other different functions of CLEAR button can also be set by calling this function.	
Parameters	KeyFlag	**0x00:** The PIN has already been cleared or there is no input PIN. Press the CLEAR button, the PED will quit the input status and will return ERR_PED_INPUT_CLEAR. **0x01:** While calling this function, during the input process of the key input interfaces (OsPedGetPinBlock, OsPedGetPinDukpt, OsPedVerifyPlainPin, and OsPedVerifyCipherPin etc), press CLEAR button to clear the latest input PIN digit by digit. When all the input PIN has been deleted, there will be no response if you keep pressing the CLEAR button, and it will not exit the PIN input function. **0x02:** It is allowed to press ATM4 button to end the PIN input. This rule does not apply to the models without ATM button. **0x03:** It is allowed to press Function button to end the PIN input. This rule does not apply to the models without FN button. **0xff:** It means restore the default function of the function keys. (Press CLEAR button to clear all PIN; press ATM4/FN key does not exit the PIN input function.)
Return	RET_OK	Success.
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

NOTE

During PIN entry, if needs to support keypress to exit or clear input PIN one by one; it should call this function once after startup.

6.4.8 OsPedClose

Prototype	**void OsPedClose(void);**

Function	Close the PED device.	
Parameters	None	
Return	None	
Instruction	This function should be called to close device before the program exits.	

6.4.9 OsPedCancelPinEntry

Property	**int OsPedCancelPinEntry(void);**	
Function	Terminate the PIN entry.	
Parameter	None	
Return	RET_OK	Success.
	ERR_DEV_NOT_OPEN	PED device is not open.
Instruction	Terminate the process of inputting PIN.	

6.5 MK/SK

6.5.1 OsPedWriteKey

Prototype	**int OsPedWriteKey (const unsigned char * KeyBlock);**		
Function	Write in a key, including write in and divergent of TLK, TMK and TWK, and use KCV to check the key correction.		
Parameters	KeyBlock【Input】	1 byte	Format: 0x03
		1 byte	SrcKeyType: ▪ PED_TLK ▪ PED_TMK ▪ PED_TPK/PED_TAK/PED_TDK
		1 byte	SrcKeyIdx: ▪ When SrcKeyType = PED_TLK, SrcKeyIdx = 1; ▪ When SrcKeyType = PED_TMK, SrcKeyIdx = [1~100]; ▪ When writing in plaintext, SrcKeyIdx = 0
		1 byte	DstKeyIdx: ▪ When DstKeyType = PED_TLK, DstKeyIdx = 1; ▪ When DstKeyType = PED_TMK, DstKeyIdx = [1~100]; ▪ When DstKeyType = PED_TPK or PED_TAK or PED_TDK,

			DstKeyIdx = [1~100].
		7 bytes	Reserved domain. Random number.
		1 byte	DstKeyType: ▪ PED_TLK ▪ PED_TMK ▪ PED_TPK/PED_TAK/PED_TDK
		1 byte	DstKeyLen: 8/16/24
		8/16/24 bytes	DstKeyValue. The destination key plaintext / ciphertext
		1 byte	KcvMode: **0x00:** No authentication **0x01:** Performs DES/TDES encryption on 8-byte 0x00, and uses first 3 bytes in ciphertext as KCV. **0x02:** Firstly, performs parity check, then does DES/TDES encryption on "\x12\x34\x56\x78\x90\x12\x34\x56", and uses first 3 bytes in ciphertext as KCV. **0x03:** Transfers in a string of KcvData, uses source key to perform specified MAC on [DstKeyValue + KcvData], and then gets the result as KCV.
		128 bytes	KcvData: ▪ When KcvMode is 0x00/0x01/0x02, padding with random numbers. ▪ When KcvMode is 0x03, the first byte of KcvData is the length of KCV data which participate in the calculation, the rest is KCV data. The first byte after the KCV data represents the MAC operation mode.
		8 bytes	▪ When KcvMode = 0x00, padding with random numbers. ▪ When KcvMode =0x01/0x02/0x03, KcvValue points to the KCV value.
		10 bytes	Padding with random number.
Return	RET_OK	Success.	
	ERR_DEV_NOT_OPEN	PED device is not open.	
	ERR_INVALID_PARAM	Invalid parameter.	
	Others	Refer to the PED Return code list .	

Instruction	Writing the ciphertext and plaintext to the specific index position of the specific key type area. This function has following key points: 1. When SrcKeyIdx=0, system considers that the DstKeyValue is the plaintext of key and does not judge SrcKeyType and SrcKeyIdx. Write the DstKeyValue to DstKeyIdx in DstKeyType area directly. 2. Only when PED_TLK does not exist, to type-in plain text or download any key is allowed. 3. When PED_TLK exist, it is not allowed to type in plaintext or download key. PED_TLK can be 16 or 24 bytes.8-byte key is not allowed. 4. Format PED to clear all downloaded keys and then write in PED_TLK. 5. If SrcKeyIdx is valid, PED considers the DstKeyValue as the key ciphertext, thus decrypt it using SrcKeyIdx key and write the key to DstKeyIdx. DstKeyType >= SrcKeyType. 6. DstKeyLen only can be of 8, 16 or 24 bytes. If DstKeyLen = 8 bytes, the key could only be used for DES calculation. If DstKeyLen = 16 or 24 bytes, the key could be used for TDES calculation. DstKeyLen <= SrcKeyLen. 7. If DstKeyType=PED_TPK, the key only be used to encrypt PIN Block. If DstKeyType=PED_TAK, the key can only be used for MAC encryption. If DstKeyType=PED_TDK, the key can only be used for *DES/TDES. 8. KCV is the verification for plaintext. If plaintext is typed-in directly, the KcvMode of KeyIn is not 0 and the system will do the KCV verification for plaintext according to the specified KcvMode. 9. The valid KeyBlock must be 184 bytes, and the users must pass in valid parameters, otherwise an error will occur.

6.5.2 OsPedWriteTIK

Prototype	**int OsPedWriteTIK (const unsigned char * KeyBlock);**		
Function	Write in a TIK, and check the key correction by KCV.		
Parameters	KeyBlock【Input】	1 byte	Format: 0x03
		1 byte	SrcKeyType: ▪ PED_TLK
		1 byte	SrcKeyIdx: ▪ When SrcKeyType = PED_TLK, SrcKeyIdx = 1; ▪ When plaintext writing, SrcKeyIdx = 0.
		1 byte	DstKeyIdx: DstKeyIdx = [1~100];
		7 bytes	Reserved domain. Random number.
		1 byte	DstKeyType: ▪ PED_TIK
		1 byte	DstKeyLen: 8/16

		24 bytes	DstKeyValue. The destination key plaintext / ciphertext
		1 byte	KcvMode: **0x00:** No authentication. **0x01:** Performs DES/TDES encryption on the 8-bytes 0x00, and uses first 3 bytes in ciphertext as KCV. **0x02:** Performs parity check 1st, then performs DES/TDES encryption on 8 bytes "\x12\x34\x56\x78\x90\x12\x34\x56", and uses first 3 bytes in ciphertext as KCV. **0x03:** Sends in data KcvData, uses source key to perform specified mode of MAC on [aucDesKeyValue + KcvData], and use the result as KCV.
		128 bytes	KcvData: ▪ When the KcvMode is 0x00/0x01/0x02, padding with random numbers. ▪ When the KcvMode is 0x03the first byte of KcvData is the length of KCV data which participate in the calculation, the rest is KCV data. The first byte after the KCV data represents the MAC operation mode.
		8 bytes	▪ When KcvMode = 0x00, padding with random numbers. ▪ When KcvMode = 0x01/0x02/0x03, KcvValue point to the KCV value.
		10 bytes	Initialize KSN.
Return	RET_OK	Success	
	ERR_DEV_NOT_OPEN	PED device is not open.	
	ERR_INVALID_PARAM	Invalid parameter	
	Others	Refer to the PED Return code list .	
Instruction	Writes the cryptograph and plaintext of a key to the specific index position of the specific key type area. This function has following key points: 1. When SrcKeyIdx=0, system considers that the DstKeyValue is the plaintext of key and will not check the SrcKeyType and SrcKeyIdx. Write the DstKeyValue to DstKeyIdx in DstKeyType area directly. 2. Only when PED_TLK does not exist, it is allowed to type-in plaintext or download any key. 3. When PED_TLK exist, it is not allowed to type in plaintext or download key. 4. If SrcKeyIdx is valid, PED considers the DstKeyValue as key		

	cryptography thus decrypts it by SrcKeyIdx key and writes the key to DstKeyIdx. DstKeyType >= SrcKeyType. 5. KCV is verification for plaintext. If plaintext is typed-in directly, and the KcvMode of KeyIn is not 0, the system will process KCV verification for plaintext according to the specified KcvMode. 6. The valid KeyBlock must be 184 bytes, and the users must pass in valid parameters, otherwise an error will occur.

6.5.3 OsPedWriteKeyVar

Prototype	**int OsPedWriteKeyVar(int KeyType,** **int SrcKeyIdx,** **int DstKeyIdx,** **const unsigned char * KeyVar);**	
Function	Uses the key plaintext that specified by source key index and key type, to do operation with a string of data and write the result to the location, specified by the destination key index with the same key type.	
Parameters	KeyType	▪ PED_TMK ▪ PED_TPK ▪ PED_TAK ▪ PED_TDK
	SrcKeyIdx	The source key index
	DstKeyIdx	The destination key index
	KeyVar 【Input】	24 bytes. The extensible input data to be used in exclusive-or, length of it should be same as the key.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter
	Others	Refer to the PED Return code list .
Instruction	Please refer to AS2805.6.	

6.5.4 OsPedSetAsteriskLayout

Prototype	**int OsPedSetAsteriskLayout(int x,** **int y,** **int fontSize,** **int fontColor,**

	uchar align);	
Function	Sets how to display the layout attributes of asterisk while inputting PIN.	
Parameters	x	X-coordinate
	y	Y-coordinate
	fontSize	Font size of asterisk: ▪ fontSize = 16, represents the character has 16 dots; ▪ fontSize = 24, represents the character has 24 dots; ▪ fontSize = 32, represents the character has 32 dots; ▪ fontSize = 48,represents the character has 48 dots; Display the asterisk with PED internal font, and it is not relevant to system installed font.
	fontColor	Font color of asterisk. Using the macro definition RGB (_r, _g, _b) and according to the input three-primary colors to generate color value with 16-bit.
	align	Alignment: ▪ PED_ASTERISK_ALIGN_LEFT; ▪ PED_ASTERISK_ALIGN_CENTER ▪ PED_ASTERISK_ALIGN_RIGHT
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	1. The PIN input interface is displayed by the application, this function will only display asterisk. 2. It needs to call this function to set the displaying layout of asterisk before using PedVerifyPlainPin, PedVerifyCipherPin, PedGetPinBlock and PedGetPinDukpt.	

6.5.5 OsPedGetPinBlock

Prototype	**int OsPedGetPinBlock (int KeyIdx,** **const unsigned char * DataIn,** **const char * ExpPinLen,** **int Mode,** **unsigned long TimeoutMs,** **unsigned char * PinBlock);**
Function	Scan the keyboard PIN entry and output the PIN BLOCK in a specific time. Input the PIN in the length specified by ExpPinLenIn, output the PIN BLOCK generated by algorithm encryption specified by Mode.

Parameters	KeyIdx	[1-100] Index of TPK.
	DataIn【Input】	▪ If Mode=0x00, **DataIn** is 16 bytes primary account number after shifting. ▪ If Mode=0x01, Input parameters for participation in PinBlock formatting, 8 bytes data. (Refer to ISO9564 standard, this data can be Random number, transaction serial number or time stamp, etc.) ▪ If Mode=0x02, **DataIn** is 16 bytes primary account number after shifting. ▪ If Mode=0x03, **DataIn** is ISN [6 Bytes, ASCII code].
	ExpPinLen 【Input】	Enumeration of 0-12 Application enumerates all possible lengths of PIN. ',' will be used to separate each number of length. If no PIN, or 4 or 6 digits of PIN are allowed, the string will be set as '0, 4, and 6'. 0 means that no PIN is required and pressing 'Enter' will return.
	Mode	PIN BLOCK format ▪ 0x00 0x00 ISO9564 format 0 ▪ 0x01 0x01 ISO9564 format 1 ▪ 0x02 0x02 ISO9564 format 3 ▪ 0x03 0x03 HK EPS format
	TimeoutMs	The timeout of PIN entry [ms] Maximum is 300000ms. 0: Without timeout or related control for PED.
	PinBlock 【Output】	8bytes. Point to the generated PINBlock.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	Press '**CANCEL**' to cancel input.	

6.5.6 OsPedUpdatePinBlock

Prototype	**int OsPedUpdatePinBlock (int UpdateFlag,** **const unsigned char * KeyInfo,** **const unsigned char * DataIn,** **unsigned char * PinBlock,**

	int Mode);	
Function	Recalculates PINBlock and chooses to replace TPK.	
Parameters	UpdateFlag	0: Do not replace TPK, Non zero: Replace TPK
	KeyInfo【Input】	▪ It has 184 bytes, please refer to the KeyBlock definition in OsPedWriteKey() for more detail. ▪ When UpdateFlag is 0, only ucDstKeyIdx is valid, adopt ucDstKeyIdx, specified by TPK and recalculate PINBLOCK. ▪ When UpdateFlag is 1, please refer to the OsWriteKey.
	DataIn 【Input】	▪ When UpdateFlag is 0 and Mode=0x03, Transaction serial number ISN [6 Bytes, ASCII code]. ▪ When UpdateFlag is non-zero, it can be NULL.
	PinBlock 【Output】	8 bytes. Input original PINBlock data, output new PINBLOCK.
	Mode	0x03 HK EPS dedication format[Appendix EPS_PINBLOCK Format]
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	For EPS.	

6.5.7 OsPedGetMac

Prototype	**int OsPedGetMac(int KeyIdx, const unsigned char *DataIn, int DataInLen, unsigned char *Mac, int Mode);**	
Function	Use MAC key specified by the KeyID to do the MAC operation for the following Mode algorithm, output the 8-byte result to Mac.	
Parameters	KeyIdx	TAK index. [1~100]
	DataIn【Input】	<=1024 bytes The data package that needs to do the MAC operation.

	DataInLen	The length of data package. If the length is not a multiple of 8, 0x00 will be padded automatically.
	Mac【Output】	8 bytes, output of MAC.
	Mode	1. 0x00: Performs the DES/TDES encryption for BLOCK1 by using MAC key, and then do it again by using TAK when and after bitwise XOR the previous encryption result with BLOCK 2. Processes in turn to get the 8 bytes encryption result. 2. 0x01: Performs s bitwise XOR for BLOCK1 and BLOCK 2; and then do it again by using previous XOR result with BLOCK3, and finally gets the 8 bytes XOR result. Use TAK to process DES/TDES encryption for the result. 3. 0x02: ANSIX9.19 standard. Performs DES encryption for BLOCK1 by using TAK (only take the first 8 bytes of the key). The encryption result will bitwise XOR with BLOCK 2, and then does it again by using TAK to get the 8 bytes encryption result. Until DES/TDES encryption for the last time.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	For EPS.	

6.5.8 OsPedDes

Prototype	**int OsPedDes(int KeyIdx, unsigned char * InitVector, const unsigned char *DataIn, int DataInLen, unsigned char *DataOut, int Mode);**	
Function	Uses the TDK to do the DES/TDES decryption for the data and then outputs plaintext or ciphertext. A specified TDK can be used for encryption and decryption algorithms.	
Parameters	KeyIdx	TDK index. [1~100].
	InitVecto 【Input】	Used for CBC/OFB encryption or decryption. If set to NULL, it will set the initialization vector as

		“\x00\x00\x00\x00\x00\x00\x00\x00” by default. It is not needed for ECB encryption or decryption, and can be set to NULL.
	DataIn 【Input】	Points to the data that needs to be calculated.
	DataInLen	Data length. It should be <=1024 and multiple of 8.
	DataOut【Output】	Points to the data that has been calculated.
	Mode	▪ 0x00: ECB Decryption ▪ 0x01: ECB Encryption ▪ 0x02: CBC Decryption ▪ 0x03: CBC Encryption ▪ 0x04: OFB Decryption ▪ 0x05: OFB Encryption
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

NOTE

Using DES or TDES depends on the key length.

6.5.9 OsPedGetKcv

Prototype	**int OsPedGetKcv (int KeyType,** **int KeyIdx,** **int KcvMode,** **int KcvDataLen,** **unsigned char * KcvData,** **unsigned char * Kcv);**
Function	Gets KCV value for key verification of two sides: 1. While it isn’t TIK: uses specific key and algorithm to encrypt the data, and then return the first 3 bytes of the cryptograph. 2. While it is TIK: returns the 8-byte KCV which was injected while

	TIK-injection.	
Parameters	KeyType	▪ PED_TLK ▪ PED_TMK ▪ PED_TAK ▪ PED_TPK ▪ PED_TDK ▪ PED_TIK
	KeyIdx	Index number of the key, for example: ▪ TLK can only be 1. ▪ TMK takes range value from 1 to 100. ▪ TWK takes range value from 1 to 100. ▪ TIK takes range value from 1 to 100.
	KcvMode	**0x00:** KCV check mode.
	KcvDataLen	The data length used in the KCV calculation. It should be <=128 bytes and be the multiple of 8. It can be "0" if the type is TIK.
	KcvData【Input】	Points to the data that needs to be calculated. It can be NULL if the type is TIK.
	Kcv 【Output】	3 or 8bytes. Points to KCV. KCV of TIK has 8 bytes, other types have 3 bytes.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

6.5.10 OsPedDeriveKey

Prototype	**int OsPedDeriveKey (int SrcKeyType, int SrcKeyIdx, int DstKeyType, int DstFromKeyIdx, int DstToKeyIdx, int Mode);**
Function	Divergent key. Uses the key specified by SrcKeyIdx to do the encryption or decryption for the key specified by DstFromKeyIdx, then derives a new key

	and save it as the specified key of DstToKeyIdx.	
Parameters	SrcKeyType	Types of the source key. ▪ PED_TLK ▪ PED_TMK ▪ PED_TAK ▪ PED_TPK ▪ PED_TDK
	SrcKeyIdx	Index number of source key, for example: ▪ TLK can only be 1. ▪ TMK takes range value from 1 to 100. ▪ TWK takes range value from 1 to 100.
	DstKeyType	Types of the destination key ▪ PED_TLK ▪ PED_TMK ▪ PED_TAK ▪ PED_TPK ▪ PED_TDK
	DstFromKeyIdx	Source index of the destination key
	DstToKeyIdx	Destination index of the destination key
	Mode	**0x00:** DES/TDES decryption **0x01:** DES/TDES encryption
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	The source key level should not be lower than the destination key type.	

6.6 DUKPT

6.6.1 OsPedGetPinDukpt

Prototype	**int OsPedGetPinDukpt(int GroupIdx,** **const unsigned char * DataIn,** **const char * ExpPinLen,** **int Mode,**

	unsigned long TimeoutMs, **unsigned char * Ksn,** **unsigned char * PinBlock);**	
Function	Scans the input PIN in a specified time, and outputs the PINBlock which generated by computing the PIN key of DUKPT.	
Parameters	GroupIdx	DUKPT group ID. [1~100]
	DataIn 【Input】	1. If Mode=0x20, **DataIn** is the 16 bytes primary account number after shifting. 2. If Mode=0x21, inputs parameters for participation in PinBlock formatting, 8 bytes data (refer to ISO9564 standard, this data can be Random numbers, the transaction serial number or time stamp, etc.) 3. If Mode=0x22, **DataIn** is the 16 bytes primary account number after shifting. 4. If Mode=0x23, **DataIn** is ISN [6 Bytes, ASCII code]
	ExpPinLen【Input】	0~12 enumerate set. Application enumerates all possible lengths of PIN. ‘,’ will be used to separate each length. If no PIN, or 4 or 6 digits PIN are allowed, the string should be set to ‘0, 4, 6’. 0 means that no PIN is required and pressing ‘Enter’ will return.
	Mode	Choose the format of PIN BLOCK **0x20:** ISO9564 format 0, KSN not plus 1 automatically. **0x21:** ISO9564 format 1, KSN not plus 1 automatically. **0x22:** ISO9564 format 2, KSN not plus 1 automatically. **0x23:** HK EPS format, KSN not plus 1 automatically.
	TimeoutMs	The timeout of PIN entry [ms] Maximum is 300000ms. 0 means there is no timeout time, PED doesn’t have to do the timeout control.
	Ksn 【Output】	Points to the current KSN.(10 bytes)
	PinBlock【Output】	Points to the generated PIN Block result.(8 bytes)
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	When KSN does not plus 1, a DUKPT PIN key can only calculate the PIN BLOCK for once.	

6.6.2 OsPedGetMacDukpt

Prototype	**int OsPedGetMacDukpt(int GroupIdx, const unsigned char *DataIn, int DataInLen, unsigned char *Mac, unsigned char *Ksn, int Mode);**	
Function	Calculate MAC by using MAC key of DUKPT.	
Parameters	GroupIdx	DUKPT group ID. [1~100]
	DataIn 【Input】	Points to the data that needs to calculate the MAC.
	DataInLen	The data length should be <=1024. If the length is not the multiple of 8, 0x00 will be padded automatically.
	Mac 【Output】	Points to the obtained MAC.
	Ksn 【Output】	Points to the current KSN.
	Mode	1. 0x20: Perform TDES encryption for BLOCK1 by using MAC key. Does TDES encryption again by using TAK when and after bitwise XOR the previous encryption result with BLOCK 2. Processes in turn to get the 8 bytes encryption result. 2. 0x21: Does bitwise XOR for BLOCK1 and BLOCK 2; Does bitwise XOR again by using previous XOR result with BLOCK3. Does it in turn and finally gets the 8 bytes XOR result. Uses TAK to process TDES encryption for the result. 3. 0x22: ANSIX9.19 standard, Does DES encryption for BLOCK1 by using TAK (only take the first 8 bytes of key). The encryption result will bitwise XOR with BLOCK2 and then does DES encryption by using TAK again. Does it in turn and gets the 8 bytes encryption result. Uses TDES to encrypt in the last time. 4. 0x20/0x21/0x22: KSN not plus 1 automatically. 5. 0x40/0x41/0x42: The MAC calculation method is the same with 0x20/0x21/0x22. 6. 0x40/0x41/0x42: Chooses to response the MAC key. 7. 0x20/0x21/0x22: KSN chooses to request and response MAC key 8. 0x40/0x41/0x42: KSN not plus 1 automatically. 9. Other values are reserved for extended MAC algorithm.

Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	If KSN does not increase, both the response MAC key and the response-request MAC key can calculate MAC for unlimited times.	

6.6.3 OsPedDesDukpt

Prototype	**int OsPedDesDukpt (int GroupIdx, int KeyVarType, unsigned char *InitVector, int DataInLen, unsigned char *DataIn, unsigned char *DataOut, unsigned char *Ksn, int Mode);**	
Function	Uses DES/MAC key of DUKPT to do encryption and decryption for the input data.	
Parameters	GroupIdx	DUKPT group ID. [1~100]
	KeyVarType 【Input】	**0x00:** Uses the requests and responses of MAC key **0x01:** Uses DES key of DUKPT **0x02:** Uses the PIN variant to encrypt the data and it is only available for ECB encryption that means the Mode can only be 1.
	InitVector 【Input】	Used for CBC/OFB encryption or decryption. If set to NULL, it will set the initialization vector as "\x00\x00\x00\x00\x00\x00\x00\x00" by default.(8 bytes) It is not needed for ECB encryption, and can be set to NULL.
	DataInLen	The data needed to be calculated should be <= 8192 bytes.
	DataIn 【Input】	Input data.
	DataOut 【Output】	Points to the data that has been calculated.

	Ksn 【Output】	Current KSN(10 bytes)
	Mode	▪ 0x00: ECB decryption ▪ 0x01: ECB encryption ▪ 0x02: CBC decryption ▪ 0x03: CBC encryption ▪ 0x04: OFB decryption ▪ 0x05: OFB encryption
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	When KSN is unchanged, and KeyVarType is 0x00 or 0x01, a set of the DUKPT key can do DES operations for 256 times at most. When KeyVarType is 0x02, a set of the DUKPT key can only do the DES operation for once.	

6.6.4 OsPedGetKsnDukpt

Prototype	**int OsPedGetKsnDukpt (int GroupIdx, unsigned char * Ksn);**	
Function	Reads the current KSN value.	
Parameters	GroupIdx	DUKPT group ID. [1-100]
	Ksn 【Output】	Points to the current KSN. (10 bytes)
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

6.6.5 OsPedIncreaseKsnDukpt

Prototype	**int OsPedIncreaseKsnDukpt (int GroupIdx);**	
Function	Increases KSN value of the specific DUKPT group.	
Parameters	GroupIdx	1-100: DUKPT group ID
Return	RET_OK	Success
	ERR_DEV_NOT	PED device is not open.

	_OPEN	
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

6.7 RSA

6.7.1 OsPedReadRsaKey

Prototype	**int OsPedReadRsaKey (int RsaKeyIdx, ST_RSA_KEY * RsaKey);**	
Function	Reads the RSA public key.	
Parameters	RsaKeyIdx	1~10: Index of RSA Key.
	RsaKey 【Output】	RSA public key.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	It can only read the RSA public key, while reads private key, returns error.	

6.7.2 OsPedWriteRsaKey

Prototype	**int OsPedWriteRsaKey (int RsaKeyIdx, ST_RSA_KEY * RsaKey);**	
Function	Inject RSA key into the PED.	
Parameters	RsaKeyIdx	1~10: Index of RSA Key.
	RsaKey 【Input】	Points to the RSA key that needs to be injected into PED.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction	The type of RSA key is depending on the exponent’s length, it is the private	

	key if the length equals to modulus.

NOTE

1. Currently it does not support RSA key whose length is more than 256 bytes.
2. RSA key can be rewritten at any time.

6.7.3 OsPedRsaRecover

Prototype	**int OsPedRsaRecover (int KeyIdx, int DataInLen, unsigned char * DataIn, unsigned char * DataOut, unsigned char * KeyInfo);**	
Function	Uses the RSA key stored in PED to process data operation.	
Parameters	RsaKeyIdx	1~10: Index of RSA Key.
	DataInLen	The length of operation data which is the same as the RSA modulus, the size in bytes. The length can be the value which is multiples of 8 and should also between 64 bytes and 256 bytes.
	DataIn 【Input】	Points to the data that needs to be calculated.
	DataOut 【Output】	Points to the data that has been calculated.
	KeyInfo 【Output】	Key information
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

6.7.4 OsPedReadCipherRsaKey

Prototype	**int OsPedReadCipherRsaKey (int RsaKeyIdx, unsigned char * CipherRsaKey);**
Function	Reads the ciphertext of RSA key.

Parameters	RsaKeyIdx	Index of RSA Key. [1~10]
	CipherRsaKey【Output】	Points to the ciphertext data of RSA key.
Return	>0	The byte length of the RSA ciphertext.
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

6.7.5 OsPedWriteCipherRsaKey

Prototype	**int OsPedWriteCipherRsaKey (int RsaKeyIdx, int CipherRsaKeyLen, unsigned char * CipherRsaKey);**	
Function	Writes the ciphertext of RSA key.	
Parameters	RsaKeyIdx	Index of RSA Key. [1~10]
	CipherRsaKeyLen	The byte length of the ciphertext data of RSA key.
	CipherRsaKey【Input】	Points to the ciphertext data of RSA key.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	PED device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

6.8 AES

6.8.1 OsPedWriteAesKey

Prototype	**intOsPedWriteAesKey (const unsigned char * KeyBlock);**		
Function	Write in an AES key and use KCV to check the key correction.		
Parameters	KeyBlock 【Input】	1 byte	Format: 0x03
		1 byte	SrcKeyType: ▪ PED_TLK

			▪ PED_TMK
		1 byte	SrcKeyIdx: ▪ When SrcKeyType = PED_TLK, SrcKeyIdx = 1; ▪ When SrcKeyType = PED_TMK, SrcKeyIdx = [1~100]; ▪ If ucSrcKeyIdx = 0, key will be written in PED as plain text.
		1 byte	DstKeyIdx: [1-100].
		7 bytes	Reserved domain. Random number.
		1 byte	DstKeyType: PED_TAESK
		1 byte	DstKeyLen: 16/24/32
		32 bytes	DstKeyValue: The destination key plain-text or cipher-text.
		1 byte	KcvMode: **0x00:** No KCV check. **0x01:** Performs AES ECB encryption on 16-byte 0x00, and use first 3 bytes as KCV. **0x02:** Perform parity check at first, then perform AESECB encryption on 16 bytes "\x12\x34\x56\x78\x90\x12\x34\x56 \x12\x34\x56\x78\x90\x12\x34\x56" , and use first 3 bytes as KCV. **0x03:** Transfers in a string of KcvData, use source key to perform specified mode MAC on [DstKeyValue (cipher) + KcvData], and use the result as KCV.
		128 bytes	KcvData: ▪ When KcvMode is 0x00/0x01/0x02, padding with random numbers. ▪ When KcvMode is0x03, the first byte of KcvData is the length of KCV data which participates in the calculation, the rest is KCV data. The first byte after the KCV data represents the MAC operation mode.
		8 bytes	▪ When KcvMode = 0x00, padding with random numbers. ▪ When KcvMode =0x01/0x02/0x03, KcvValue point to the KCV value.
		2 bytes	Padding with random number.
Return	RET_OK	Success	
	ERR_DEV_NOT_	Device is not open.	

	OPEN ERR_INVALID_PARAM — Invalid parameter. Others — Refer to the PED Return code list.
Instruction	Writing the cryptograph and plaintext of an AES key to the specific index position of the AES area. This function has following key points: 1. When SrcKeyIdx=0, system consider that the DstKeyValue is the plaintext of key and does not judge SrcKeyType and SrcKeyIdx. Write the DstKeyValue to DstKeyIdx in DstKeyType area directly. 2. Only when PED_TLK does not exist, to inject plaintext or download any key into PED is allowed. 3. When PED_TLK exist, it is not allowed to inject in plaintext or download key. 4. If SrcKeyIdx is valid, PED considers the DstKeyValue as the key cryptography, thus decrypt it using SrcKeyIdx key and write the key to DstKeyIdx. 5. The valid KeyBlock must be 184 bytes, and the users must pass a valid parameter to it, otherwise an error will occur.

6.8.2 OsPedAes

Prototype	**intOsPedAes(intKeyIdx, unsigned char * InitVector, const unsigned char *DataIn, intDataInLen, unsigned char *DataOut, int Mode);**	
Function	Uses the specified AES key stored in PED to do the AES encryption or decryption for the data and then output ciphertext or plaintext.	
Parameters	KeyIdx 【Input】	TAESK index: 1~100.
	InitVector 【Input】	Used for CBC/OFB encryption or decryption. If set to NULL, it will set the initialization vector as "\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00" by default. It is not needed for ECB encryption or decryption, and can be set to NULL.
	DataIn 【Input】	Points to the data that needs to be calculated.
	DataInLen 【Input】	Data length. It should be <=1024, and multiple of 16.
	DataOut 【Output】	Points to the data that has been calculated.

	Mode 【Input】	**0x00:** ECB Decryption **0x01:** ECB Encryption **0x02:** CBC Decryption **0x03:** CBC Encryption **0x04:** OFB Decryption **0x05:** OFB Encryption
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	Device is not open.
	ERR_INVALID_PARAM	Invalid parameter.
	Others	Refer to the PED Return code list .
Instruction		

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7 LCD

In Prolin, the operation of displaying contents on LCD is managed by the GUI; it supports the graphics systems such as Minigui, QT. In this chapter, it will provide OsScrBrightness(), OsScrContrast(), OsScrGetSize() and some related interfaces for application use.

Application can adopt the XUI graphic interfaces that provided by PAX, for more details; refer to the “XUI Programming Guide”. It also can develop the GUI system by itself, or it can use FrameBuffer approach to test the validity of the LCD driver. OsScrContrast(), OsScrBrightness(), OsScrGetSize() and the rest of the LCD operations are managed by the GUI.

Applications (such as driver testing) can also operate FrameBuffer directly. Details are as follows:

1. Open the FrameBuffer device, the device node is “/dev/fb”;
2. Get the fixed screen information through ioctl,
3. Get the variable screen information through ioctl,
4. Map device memory to the process space through mmap,
5. Write the FrameBuffer.

```
int open_screen(void)
{
    char vtname[128];
    int fd, nr;
    unsigned y, addr;
    struct fb_fix_screeninfo fix;
    sb = (screen_buffer*)malloc(sizeof (screen_buffer));
    if ((sb->dev_fd = open(FB_DEV_PATH, O_RDWR)) == -1) {
    perror("open");
    return -1;
    }

    int ret = ioctl(sb->dev_fd, FBIOGET_VSCREENINFO, &fb_vinfo);

    if (ret) {
     sb->width = FB_WIDTH;
    sb->height = FB_HEIGHT;
    sb->bytes_per_pixel = FB_BYTES_PER_PIXEL;
    fprintf(stderr,"in %s line %d",__FUNCTION__,__LINE__);
    } else {
    sb->width = fb_vinfo.xres;
    sb->height = fb_vinfo.yres;
    sb->bytes_per_pixel = fb_vinfo.bits_per_pixel / 8;
    }
    if(sb->bytes_per_pixel == 3)
    sb->bytes_per_pixel = 4;

    if (ioctl(sb->dev_fd, FBIOGET_FSCREENINFO, &fix) < 0) {
     close(sb->dev_fd);
     return -1;
    }

    fbmemlen = sb->width * sb->height * sb->bytes_per_pixel;

    if ((sb->buffer = (uint8_t *) mmap(NULL, fbmemlen, PROT_READ | PROT_
WRITE,MAP_FILE |MAP_SHARED, sb->dev_fd, 0)) == (uint8_t *) -1)
    {
    fprintf (stderr, "rw_sd_inand.c: Can't mmap frame buffer ++\n");
    exit (1);
    }
    memset(sb->buffer, 0, fbmemlen);
    return 0;
}
```

1. Close the FrameBuffer device

```
void close_screen(screen_buffer *sb)
{
    if(!sb)
    return;
    // Unmap the framebuffer
    munmap(sb->buffer, fbmemlen);
    // Close framebuffer device
    close(sb->dev_fd);
    free(sb);
}
```

7.1 OsScrContrast

Prototype	**void OsScrContrast(int Contrast);**	
Function	Sets the contrast.	
Parameters	Contrast	Contrast level [0~7]. 0: darkest 7: lightest Default value: 4. Other values: no action.
Return	None	
Instruction	This function is only applicable to monochrome LCD.	

7.2 OsScrBrightness

Prototype	**void OsScrBrightness(int Brightness);**	
Function	Sets the screen brightness.	
Parameters	Brightness	Brightness level [0~10]. 0: turn off the backlight 10: lightest value All brightness values are visible。 Default value: 8. Other values: no action.
Return	None	
Instruction		

7.3 OsScrGetSize

Prototype	**void OsScrGetSize(int *Width, int *Height);**	
Function	Gets the LCD Physical screen size.	
Parameters	Width【Output】	Width (unit: pixel).
	Height【Output】	Height (unit: pixel).
Return	None	
Instruction	The screen size is just a read-only property. The interface only applys to the applications that does not support GUI.	

8 Keyboard

The keyboard input of Prolin is managed by GUI.

Key value definition

Macro	Value	Description
KEY1	2	KEY”1”
KEY2	3	KEY “2”
KEY3	4	KEY“3”
KEY4	5	KEY“4”
KEY5	6	KEY“5”
KEY6	7	KEY“6”
KEY7	8	KEY“7”
KEY8	9	KEY“8”
KEY9	10	KEY“9”
KEY0	11	KEY“0”
KEYCANCEL	223	KEY“CANCEL”
KEYCLEAR	14	KEY“CLEAR”

KEYENTER	28	KEY“ENTER”
KEYALPHA	69	KEY “Alpha”
KEYF1	59	At the bottom of S800 LCD, the first key from left to right.
KEYF2	60	
KEYF3	61	
KEYF4	62	
KEYFUNC	*102*	Key “Function”
KEYUP	*103*	At the bottom of S800 LCD, the second key from left to right.
KEYDOWN	*108*	At the bottom of S800 LCD, the third key from left to right.
KEYMENU	*139*	At the bottom of S800 LCD, the fourth key from left to right.

The application developers can directly use the input subsystem when they need to test keyboard drivers or transplant other GUI systems. The device node of the keyboard is "/dev/keypad".

Details of calling the input subsystem are shown as follow:

```
#include <stdio.h>
#include <stdlib.h>
#include <fcntl.h>
#include <linux/input.h>
static int keypad_fd = -1;
struct input_event ev0[64];
//for handling /key/event
static int handle_event0() {
        int button = 0, realx = 0, realy = 0, i, rd;

        rd = read(keypad_fd, ev0, sizeof(struct input_event) * 64);

        if ( rd < sizeof(struct input_event) ) return 0;
        for (i = 0; i < rd / sizeof(struct input_event); i++) {
                printf("", ev0[i].type, ev0[i].code, ev0[i].value);
                if (ev0[i].type == 3 && ev0[i].code == 0)
                        realx = ev0[i].value;
                else if (ev0[i].type == 3 && ev0[i].code == 1)
                        realy = ev0[i].value;
                else if (ev0[i].type == 1) {
                        if (ev0[i].code == 158) {
                                //if key esc then exit
                                return 0;
                        }
                }
                else if (ev0[i].type == 0 && ev0[i].code == 0 && ev0[i].value == 0) {
                        realx = 0, realy = 0;
                }
                printf("event(%d): type: %d; code: %3d; value: %3d; realx: %3d;
realy: %3d\n", i,
              ev0[i].type, ev0[i].code, ev0[i].value, realx, realy);
        }
        return 1;
}

int main(void) {
       int done = 1;
        printf("sizeof(struct input_event) = %d\n", sizeof(struct input_event));
        keypad_fd = open("/dev/keypad", O_RDWR);
        if ( keypad_fd < 0 )
                return -1;
        while ( done ) {
              printf("begin handel_event0...\n");
                done = handle_event0();
              printf("end handel_event0...\n");
        }
        if ( keypad_fd > 0 ) {
                close(keypad_fd);
                keypad_fd = -1;
        }
        return 0;
}
```

8.1 OsKbBacklight

Prototype	**void OsKbBacklight(int OnOff);**	
Function	Switches the keyboard backlight.	
Parameters	OnOff	0: Turn off the backlight. Non-zero: Turn on the backlight.
Return	None	
Instruction		

9 Touch Screen

The touch screen input of Prolin is managed by GUI.

The application developers can directly use the input subsystem if they need to test touch screen drivers or transplant other GUI systems.

About input subsystem calls, refer to the example of the keyboard, the node of touch screen is "/dev/tp".

10 Signature Pad

For more details, refer to the “XUI Programming Guide”.

11 Printer

Prolin provides both virtual printing and physical printing function, and also provides the unified interface for API. For physical printer, the senior application developers can access the printer driver through a POSIX interface to achieve the specific print function.

11.1 Return code list

Table 11 Printer return code list

Macro	Value	Description
ERR_PRN_BUSY	-3701	Printer is busy
ERR_PRN_PAPEROUT	-3702	Out of paper
ERR_PRN_WRONG_PACKAGE	-3703	The format of print data packet error.
ERR_PRN_OVERHEAT	-3704	Printer overheats
ERR_PRN_OUTOFMEMORY	-3705	The print data is too large to exceed the buffer length.
ERR_PRN_OVERVOLTAGE	-3706	Voltage is too high.

11.2 Open and Close

This part includes three functions: opening, resetting and closing the printer.

11.2.1 OsPrnOpen

Prototype	**int OsPrnOpen(unsigned int printertype, const char* targetname);**	
Function	Opens the printer (including physical and virtual).	
Parameters	printertype 【Input】	Types of printer: ▪ PRN_REAL: Physical printer. ▪ PRN_BMP: Bmp virtual printer and it generates bmp format files.
	targetname 【Input】	For the physical printer, this parameter should be NULL. The other output file name of virtual printer, this parameter should fill in the file name generated by virtual printing, for example, /home/app/test.bmp.
Return	RET_OK	Success.
	ERR_DEV_NOT_EXIST	Device does not exist.
	ERR_INVALID_PARAM	Invalid parameter
	ERR_DEV_BUSY	Device is occupied
	ERR_BATTERY_ABSENT	The battery is absent
Instruction	1. This function needs to be called when the program starts to run, otherwise the associated functions won’t work. 2. Noted that S920 and D200 mobile terminals need battery to work.	

11.2.2 OsPrnReset

Prototype	**void OsPrnReset(void);**	
Function	Implements the print restoration and initialization.	
Parameters	None	
Return	None	
Instruction	Calling this function will restore the printer default settings and clear buffer data. This function is applicable to both physical printers and virtual printers.	

NOTE

After calling OsPrnReset (), the font choice of library file will be restored to default font status (only available in English).

11.2.3 OsPrnClose

Prototype	**void OsPrnClose(void);**	
Function	Closes the printer.	
Parameters	None	
Return	None	
Instruction	This function should be called to close the printer device when program exit.	

11.3 Printer settings

11.3.1 OsPrnSetSize

Prototype	**int OsPrnSetSize (unsigned int Width, unsigned int Height);**	
Function	Sets printer parameters.	
Parameters	Width【Input】	Width
	Height【Input】	Height
Return	RET_OK	Success.
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	Only applicable to the virtual printer. The default size is 384*5000, and the maximum size is 600*5000. This function is effective in the first calling, and it will not change the first settings in the following repeat calls.	

11.3.2 OsPrnSetDirection

Prototype	**int OsPrnSetDirection (unsigned char Mode);**	
Function	Sets the print direction.	
Parameters	Mode 【Input】	0: print horizontally. Non-zero: print vertically.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	This function is applicable to both physical printers and virtual printers.	

11.3.3 OsPrnSetGray

Prototype	**void OsPrnSetGray(int Level);**	
Function	Sets printing gray level.	
Parameters	Level	• Level =0, reserved, • Level =1, default level, normal print slip, • Level =2, reserved, • Level =3, two-layer thermal printing, • Level =4, two-layer thermal printing, higher gray level than 3, • The default level is 1. • The illegal value does not change current settings.
Return	None	
Instruction	Before setting gray level, it prints with the default level, after calling this function it will print with the setting level. This function is only applicable to the physical printer.	

11.4 TypeSetting

11.4.1 OsPrnSetSpace

Prototype	**void OsPrnSetSpace(int CharSpace, int LineSpace);**	
Function	Sets the printing space.	
Parameters	CharSpace	Character space (unit: pixel) (It is invalid to the mandatory non-monospaced fonts, such as Arabic fonts, Thai fonts.)
	LineSpace	Line space(unit: pixel)
Return	None	
Instruction	1. Settings will be valid until they are set again or OsPrnReset() is called; 2. Printing character space is 0 by default; 3. Printing line spaces are 0 and 2 for thermal printer and stylus printer respectively by default ; 4. The maximum line space can be 255; 5. The maximum character space can be 255; 6. Invalid parameter does not change the current settings.	

11.4.2 OsPrnSetReversal

Prototype	**int void OsPrnSetReversal(int Attr);**	
Function	Sets the reverse attribute of font, normal printing by default.	
Parameters	Attr	0: normal

		Non zero: reversal
Return	None	
Instruction	This function is applicable to both physical printers and virtual printers	

11.4.3 OsPrnSetIndent

Prototype	**int OsPrnSetIndent (unsigned int Left, unsigned int Right);**	
Function	Sets the left and right margins.	
Parameters	Left 【Input】	The left margin: the valid range is [0, 100] and the default value is 0.
	Right 【Input】	The right margin: the valid range is [0, 100] and the default value is 0.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
Instruction	If the physical printer is set to print vertically, then the left margin should correspond to the top margin of the page, and right margin corresponds to the bottom margin.	

11.4.4 OsPrnCheck

Prototype	**int OsPrnCheck(void);**	
Function	Checks the current status of printer.	
Parameters	None	
Return	RET_OK	Success.
	ERR_PRN_NOFONTLIB	Has no font library.
	ERR_PRN_BUSY	Printer is busy.
	ERR_PRN_PAPEROUT	Out of paper.
	ERR_PRN_OVERHEAT	Printer overheated.
Instruction	This function can be used to check whether there is a printing font library, whether there is paper, whether printing buffer is full, and whether the printer is overheated Only applicable to the physical printer.	

11.4.5 OsPrnGetDotLine

Prototype	**int OsPrnGetDotLine(void);**	
Function	Gets current printed dot line for slip alignment.	
Parameters	None	
Return	>=0	Current dot line.

Instruction	Used for slip alignment. This function is applicable to both physical printers and virtual printers.

11.4.6 OsPrnSetFont

Prototype	**int OsPrnSetFont(const char * fontname);**	
Function	Selects print fonts.	
Parameters	fontname【Input】	Font(file) name
Return	RET_OK	Success
	ERR_FONT_NOT_EXIST	Font does not exist.
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	It can choose a different font style and font size for printing. The system built-in font (file) name can be obtained by calling OsEnumFont () function.	

11.4.7 OsPrnSelectFontSize

Prototype	**void OsPrnSelectFontSize(int SingleCodeWidth, int SingleCodeHeight, int MultiCodeWidth, int MultiCodeHeight);**	
Function	Sets the font size.	
Parameters	SingleCodeWidth	The width control of single code font. (For non-monospaced font, width of each character may not meets the settings). The value ranges from 8 to 64.
	SingleCodeHeight	The height control of single code font. The value ranges from 8 to 64.
	MultiCodeWidth	The width control of multiple code fonts. The value ranges from 12 to 64.
	MultiCodeHeight	The height control of multiple code font The value ranges from 12 to 64.
Return	None	
Instruction	After the first calling of OsPrnOpen(), the font width and height are set to the default values (12x24) (24x24). This function is applicable to both physical printers and virtual printers.	

CAUTION

Suggest the height and width of multiple code font should be the same, otherwise, the font may display abnormally.

11.4.8 OsPrnFeed

Prototype	**void OsPrnFeed(int Pixel);**	
Function	Feeds printing paper "pixel" pixels in print buffer.	
Parameters	Pixel	number of pixels
Return	None	
Instruction	1. If the pixel value is positive, then the paper will feed forwards. If it is negative, then feed backwards. If it is 0, then no action. 2. This function is applicable to both physical and virtual printers.	

CAUTION

This is a one-time action, that is, it will lose its effect after the implementation.

11.4.9 OsPrnPrintf

Prototype	**void OsPrnPrintf(const char *Str, ...);**	
Function	Formats output string to print buffer.	
Parameters	Str【Input】	Pointer of string that needs to be printed.
Return	None	
Instruction	1. Support variable parameters; 2. Support '\n' (new line) and '\f' (new page) control characters in the string; 3. If the printing data package is too long, then the program will overflow; 4. If the string is longer than the printing boundary, it will automatically change line and continue printing; 5. The maximum buffer size is 2048 bytes; 6. Store str in printing buffer, and print data in printing buffer in sequence of writing into the buffer after calling OsPrnStart().	

11.4.10 OsPrnPutImage

Prototype	**void OsPrnPutImage(const unsigned char *Logo);**	
Function	Outputs images to the print buffer.	
Parameters	Logo【Input】	Pointer to the logo information; the length cannot be more than 20000 bytes.

Return	None
Instruction	1. Bitmap data is generated as follows: ▪ Draw a bitmap (usually a logo): use paintbrush program under Windows to draw a bitmap and save it as a "monochromatic, bmp format" file. ▪ Use "Bitmap Converter" provided by PAX to convert the .bmp file into a header file, for instance, Logo.h header file. (If more than one .bmp files are selected, after the conversion, the head file contain the same number of array\the definition of the name of the array will be associated with the BMP filename. ▪ Printing bitmap size limit: for thermal printer, up to 384 pixels in width is allowed, for stylus printer, 180 pixels are allowed, but the height is unlimited. 2. Use the generated array as the input parameter of this function. 3. If the bitmap width is larger than the limit of the printer, then it will be get rid of the redundant data on the right. . 4. If the size of the data packet is too large, then this function will remove the LOGO message.

NOTE

Format description of the image array in the header file:

First byte [1 byte]: number of rows of the bitmap;

Size of the first bitmap line in byte [2 Bytes, MSB (most significant byte)ahead];

Bitmap data of the first bitmap line [one line of the bitmap have 8 pixels in height];

Size of the second bitmap line in byte [2 Bytes, MSB ahead];

Bitmap data of the second bitmap line;

So on and so forth.

This function only stores logo into printing buffer, and begins printing data in printing buffer in sequence after calling OsPrnStart ().

11.4.11 OsPrnStart

Prototype	**int OsPrnStart(void);**	
Function	Starts printer and prints the data in the buffer.	
Parameters	None	
Return	RET_OK	Success
	ERR_PRN_BUSY	Printer is busy.

	ERR_PRN_PAPEROUT	Out of paper.
	ERR_PRN_WRONG_PACKAGE	The format of printing data package error.
	ERR_PRN_OVERHEAT	Printer overheats.
	ERR_PRN_OUTOFMEMORY	The size of the printing data is too large.
Instruction	1. After calling this API, the printer will perform the printing task and return after completing the whole printing task. 2. After completing the whole printing task, this API will return the printer status in return value. Therefore the check printer status is not required. 3. If the printing process is completed, recalling this function will reprint the slip.	

11.5 POSIX

Prolin physical printer driver module makes the POSIX programming interface open to the application developers.

11.5.1 open

Opens the physical printer, the device name is “/dev/printer”

int handle = open(“/dev/printer”, O_RDWR);

11.5.2 read

- Read the printer status. The data format of the first byte buf[0] in Read buffer is defined as follows:0x00 normal
- 0x01 printer is busy
- 0x02 out of paper
- 0x03 printer overheats
- 0x04~0xFF reserved

```
unsigned char buf[10];
 int ret = read(handle, buf, 2);
 if (ret > 0) {
        //buf[0]
 }
```

11.5.3 Write

Send the contents of printer configuration and print the buffer.

The first two bytes of the buffer are gray settings and reserved bit, suppose that the buffer is char buf [50], bit0~bit2 in the buf [0] represent the printing gray control values, bit3~bit7 are reserved.

char 0: bit0~bit2: The control value of print grayscale,

- 000(0) Reserved
- 001(1) Normal gray level
- 010(2) Reserved
- 011(3) Two-layer thermal printing A
- 100(4) Two-layer thermal printing B
- 101(5) Reserved
- 110(6) Reserved
- 111(7) Reserved

The second byte buf [1] in the buffer: reserved.

From buf [2], a single line is composed of every 48 characters (384 dots); if it is less than 48 then it will be padding with blank by the driver.

```
unsigned char buf[50];

 buf[0] = 0x01;
 memset(buf + 2, 0xff, 48);

 int ret = write(handle, buf, 50);

 if (ret < 0) {
        //Error handling……
 }
```

The limit of the maximum data length is:

For the thermal printing of 384 dots, when prints horizontally, the driver can deal with 5000 lines each time at most, if out of the range, it will not print. When prints vertically, it can deal with 384 lines each time, and each line can print 5000 dots at most, if there are more than 384 lines, it will not print. The longest length of a write buffer should be 384*5000/8 + 2 = 240002 Bytes.

11.5.4 Close

Closes the printer file handles.

```
close (handle);
```

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12 Font Library

Prolin supports Freetype as the system font library. Therefore, the system supports a series of vector font and bitmap font.

12.1 Data structure

FT_FONT	
typedef struct {	
char FileName[64];	*/* Font file name */*
char FontName[64];	*/* Font name */*
}FT_FONT;	

FT_DOT	
typedef struct {	
unsigned char Left;	*/*Font offsets left from the baseline*/*
unsigned char Top;	*/* Font offsets top from the baseline */*
unsigned char Width;	*/* Font width */*

```
    unsigned char     Height;             /* Font height */
    unsigned char     Dot[3072];          /*Valid font data */
}FT_DOT;
```

12.2 Font operation

12.2.1 OsEnumFont

Prototype	**int OsEnumFont(FT_FONT *FontList);**	
Function	Gets the vector font list provided by system.	
Parameters	FontList【Output】	Vector fonts list
Return	>=0	Read the number of vector fonts
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_FONT_NOT_EXIST	Font library does not exist.

Instruction	*Example:*
	`int i, num;`
	`FT_FONT *FontList;`
	`num = OsEnumFont(&FontList);`
	`if(num <= 0)`
	`    return -1;`
	`for(i=0; i<num; i++)`
	`    printf("[%d]file name: %s, font name : %s\n",`
	`        i,   FontList[i].FileName, FontList[i].FontName);`	

12.2.2 OsOpenFont

Prototype	**int OsOpenFont (const char *FileName);**	
Function	Loads vector fonts.	
Parameters	FileName 【Input】	Font file name.
Return	>=0	Font handle
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_FONT_NOT_EXIST	System does not install font library.

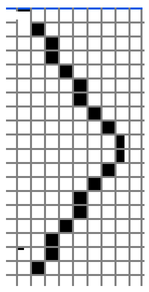
Instruction	It needs to cache the dot-matrix data after open the fonts, and it is recommended to call OsGetFontDot() after 3 seconds.

12.2.3 OsCloseFont

Prototype	**void OsCloseFont (int Handle);**	
Function	Closes vector fonts.	
Parameters	Handle 【Input】	Font handle
Return	None	
Instruction	After using vector fonts, please promptly shut down to release the system resources.	

12.2.4 OsGetFontDot

Prototype	**int OsGetFontDot (int Handle,** **const char *Utf8Code,** **const int Width,** **const int Height,** **const int Style,** **FT_DOT *FtDot);**	
Function	Gets the utf-8 encoding standard character font.	
Parameters	Handle 【Input】	Font handle
	Utf8Code 【Input】	Characters of UTF-8 encoding standards
	Width 【Input】	Font width, value range is【8, 128】.
	Height 【Input】	Font height, value range is【8, 128】.
	Style 【Input】	Font style: FONT_STYLE_NONE 0 No style FONT_STYLE_BOLD 0x00000001 Bold type FONT_STYLE_ITALIC 0x00000002 Italic type FONT_STYLE_BOLD|FONT_STYLE_ITALIC bold italics
	FtDot 【Output】	The output of font data structure.
Return	RET_OK	Success

	ERR_INVALID_PARAM	Invalid parameter
	ERR_FILE_NOT_EXIST	File does not exist.
	ERR_FONT_CODE	Font code error.
	ERR_INVALID_HANDLE	Invalid handle
Instruction	**Utf8Code input.** UTF-8 code is a variable length, and it needs to end with '\ 0', when the code is composed of letters, Utf8Code requires two bytes where Utf8Code [0] represents letter, Utf8Code [1] represents ' \ 0'; but for Chinese, Utf8Code requires four bytes where Utf8Code [0-2] represents the Chinese and Utf8Code [3] represents ' \ 0'. **The Italic style dot matrix.** When using italics effects, the obtained dot matrix width is wider than the set value. It is not recommended that the dot size should be not less than 24; otherwise the dot may not show italics effects. For example, when the dot size of Song typeface is less than 19, and the bold font dot size is less than 21, the italic effects cannot be used for Chinese, but it is available for letters. **The format of font data.** 1. All of the font dot matrix are in horizontal arrangement mode; 2. The point which corresponds to each byte, the sequence from left to right is 0x80 to 0x01; 3. If the character width that is not enough to make a integer multiple of 8,the bytes of per line dot matrix are (width+7)/8 For example: For the character “ > ”,with 10(width)x20(height)  The font data is: 0x00, 0x00, 0x20, 0x00, 0x10, 0x00, 0x10, 0x00, 0x08, 0x00,	

	0x04, 0x00, 0x04, 0x00, 0x02, 0x00, 0x01, 0x00, 0x00, 0x80, 0x00, 0x80, 0x01, 0x00, 0x02, 0x00, 0x04, 0x00, 0x04, 0x00, 0x08, 0x00, 0x10, 0x00, 0x10, 0x00, 0x20, 0x00, 0x00, 0x00 After calling this function, the character returns: Width = 10 Height = 20 Dot data: 0x00,0x00,0x20,0x00,0x10,0x00,0x10,0x00, 0x08,0x00,0x04,0x00,0x04,0x00,0x02,0x00, 0x01,0x00,0x00,0x80,0x00,0x80,0x01,0x00, 0x02,0x00,0x04,0x00,0x04,0x00,0x08,0x00, 0x10,0x00,0x10,0x00,0x20,0x00,0x00,0x00

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13 Code

Prolin supports UTF8 as the system default code, and also provides the code-conversion interface.

13.1 Code Convert

13.1.1 OsCodeConvert

Prototype	**int OsCodeConvert (const char *FromCharset, const char *ToCharset, const char *InBuf, char *OutBuf, unsigned int LenOut);**	
Function	Implement conversion of character encoding.	
Parameters	FromCharset 【Input】	The original character encoding
	ToCharset 【Input】	The target character encoding
	InBuf 【Input】	Character string of the original encoding, ending with ’\0’.Unicode should end with”\0\0”
	OutBuf 【Output】	The converted encoding string
	LenOut 【Input】	Size of array OutBuf, it should be at least 1.5 times of the array InBuf.
Return	>=0	Success, then returns the length of converted character string.

	ERR_INVALID_PARAM Invalid parameter
Instruction	Supports conversions among the following codes. *ISO-8859-(1,2,3,4,5,6,7,8,9,10,11, 13,14,15,16)* *cp(850,874,932,1250,1251,1252,1253,1254,1255,1256,1257,1258)* *GBK/GB18030(2 bytes part)* *BIG5* *SHIFT_JIS* *EUC-KR* *UNICODE* *UTF-8*

NOTE

1. The conversion is only recommended between the above codes and UTF-8 codes. Others might fail.
2. UNICODE adopts the Little-Endian mode.

14 MSR

Prolin provides the function of reading the magnetic stripe data and provides a unified API reading interface for use. In addition, senior application developers can access to the magnetic drive through the POSIX interface and directly get the magnetic stripe bit-stream to achieve different logics of magnetic stripe decoding.

14.1 Return code list

Table 12 MSR return code list

Macro	Value	Description
ERR_MSR_FAILED	-2701	Failed
ERR_MSR_HEADERR	-2702	Did not find the head mark.
ERR_MSR_ENDERR	-2703	Did not find the end mark
ERR_MSR_LRCERR	-2704	LRC check error
ERR_MSR_PARERR	-2705	One bit of MSR check error.
ERR_MSR_NOT_SWIPED	-2706	No swiping
ERR_MSR_PED_DECRYPTERR	-2709	PED decryption failed.

14.2 Data structure

MSR structure: Records information and status of each magnetic track.

ST_MSR_DATA:	
typedef struct {	
unsigned char TrackData[256];	*/*Track data buffer*/*
int DataLen;	*/* Track data length*/*
int Status;	*/*Track data status, status equal 0 indicates read track data succeed, other value indicates failed*/*
}ST_MSR_DATA;	

NOTE

When the status of track data is 0, it means reads track successfully, and it has two scenarios:

1. If the data format is correct or there is no data in track, then it needs to be combined with DataLen to be determined;
2. When Status <0, DataLen will be equal to 0, and the TackData will not include the information of magnetic track.

14.3 MSR control interface

14.3.1 OsMsrOpen

Prototype	**int OsMsrOpen(void);**	
Function	Switches on magnetic stripe reader.	
Parameters	None	
Return	RET_OK	Success
	ERR_DEV_NOT_EXIST	Device does not exist.
	ERR_DEV_BUSY	Device is busy.
	ERR_DEV_NOT_OPEN	Fail to open the device.
Instruction	Other functions can be operated only after open device successfully.	

NOTE

Magnetic stripe reader works in interrupt mode. When the magnetic stripe reader is opened, it can read the magnetic track data, even if no card-reading function is called. So it is better to switch off magnetic stripe reader when it is not in use.

14.3.2 OsMsrClose

Prototype	**void OsMsrClose(void);**	
Function	Switches off magnetic stripe reader.	
Parameters	None	
Return	None	
Instruction	This function should be called to close device when program exit.	

14.3.3 OsMsrReset

Prototype	**void OsMsrReset(void);**	
Function	Resets magnetic stripe reader	
Parameters	None	
Return	None	
Instruction	When the magnetic reader is powered on, this function resets the reader and clears the data in the buffer.	

14.3.4 OsMsrSwiped

Prototype	**int OsMsrSwiped(void);**	
Function	Checks whether a card is swiped or not.	
Parameters	None	
Return	TRUE	Card swiped
	FALSE	Not swiped
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	1. This function returns the corresponding value immediately, doesn't matter card is swiped or not. 2. Call this function to check whether a card is swiped or not. 3. After calling the OsMsrOpen(), OsMsrRead() or OsMsrReset(), the status of swiping card will be clear.	

14.3.5 OsMsrRead

Prototype	**int OsMsrRead(ST_MSR_DATA *Track1, ST_MSR_DATA *Track2, ST_MSR_DATA *Track3);**	
Function	Reads data of magnetic stripe card.	
Parameters	Track1 【Output】	Output the data of Track1
	Track2 【Output】	Output the data of Track2
	Track3 【Output】	Output the data of Track3
Return	RET_OK	Success
	ERR_MSR_NOT_SWIPED	No swiping.
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	If a certain track's data is not needed, set the corresponding pointer to NULL, then the data will not be outputted. After swiped card successfully, and users didn't call this interface to read the track data, the data will be automatically emptied. And all of the returned track data are 0x00.	

CAUTION

Calling OsMsrSwiped() first to detect the swipe actions, then callOsMsrRead() to obtain the data of magnetic track. Otherwise, when the function returns, the data included in the buffer is invalid.

NOTE

For magnetic card conforming to ISO7812:

Track1 needs 79 bytes

Track2 needs 37 bytes

Track3 needs 107 bytes

14.4 POSIX

Prolin Magnetic driver module makes the POSIX programming interface open to the senior application developers.

14.4.1 Open

Opens the magnetic stripe reader, and the device name is"/dev/msr"

int handle = open("/dev/msr", O_RDONLY);

14.4.2 Read

Read the bit stream data from magnetic stripe card.

The data format in Read buffer is defined as follows:

Variable length of data, but it is not more than 3 * 750 bytes. In the case of no card swiping, the returned data length of read is 0, and the read () may return -1. When the first byte of the buffer is 0, it presents that the following data will be plaintext magnetic track data.

The data bit stream is represented by using the ASCII code 0/1 and an ASCII code represents a bit, tracks are separated by 0x0A.

0101010101010101010000000000000000000000000000000000111111111111111111111 111111\n

0101010101010101010000000000000000000000000000000000111111111111111111111 111111\n

0101010101010101010000000000000000000000000000000000111111111111111111111 111111\n

The second byte of the buffer is 1 that means the following data will be locked by using fixed key encryption. Which needs PedMsrDecryptRaw() interface to do the decryption.

```
unsigned char buf[2250];
 int ret = read(handle, buf, 2250);
 if (ret > 0) {
        /*Bit stream decode*/
 }
```

14.4.3 Close

Closes file handles of the magnetic stripe reader.

After closing the handle, the original magnetic data stored in the drive buffer will be cleared.

close (handle);

15 ICC Reader

The basic protocol interface is customized according to the ISO7816/EMV.

15.1 Return Code List

Table 13 ICC reader return code list

Macro	Value	Description
ERR_SCI_HW_NOCARD	-2800	No card
ERR_SCI_HW_STEP	-2801	Exchange when no init, warm reset when no active
ERR_SCI_HW_PARITY	-2802	Parity error
ERR_SCI_HW_TIMEOUT	-2803	Time out
ERR_SCI_TCK	-2804	TCK error
ERR_SCI_ATR_TS	-2810	TS error in ATR
ERR_SCI_ATR_TA1	-2811	TA1 error in ATR
ERR_SCI_ATR_TD1	-2812	TD1 error in ATR
ERR_SCI_ATR_TA2	-2813	TA2 error in ATR
ERR_SCI_ATR_TB1	-2814	TB1 error in ATR

ERR_SCI_ATR_TB2	-2815	TB2 error in ATR
ERR_SCI_ATR_TC2	-2816	TC2 error in ATR
ERR_SCI_ATR_TD2	-2817	TD2 error in ATR
ERR_SCI_ATR_TA3	-2818	TA3 error in ATR
ERR_SCI_ATR_TB3	-2819	TB3 error in ATR
ERR_SCI_ATR_TC3	-2820	TC3 error in ATR
ERR_SCI_T_ORDER	-2821	Protocol is not T0 or T1
ERR_SCI_PPS_PPSS	-2830	PPSS error in PPS
ERR_SCI_PPS_PPS0	-2831	PPS0 error in PPS
ERR_SCI_PPS_PCK	-2832	TC3 error in ATRPCK error in PPS
ERR_SCI_T0_PARAM	-2840	Data in transmitting is too long in T0
ERR_SCI_T0_REPEAT	-2841	Too many character repetition in T0
ERR_SCI_T0_PROB	-2842	Procedure byte error in T0
ERR_SCI_T1_PARAM	-2850	Data in transmitting is too long in T1
ERR_SCI_T1_BWT	-2851	BWT exceed in T1
ERR_SCI_T1_CWT	-2852	CWT exceed in T1
ERR_SCI_T1_BREP	-2853	Too many block repetition in T1
ERR_SCI_T1_LRC	-2854	LRC error in T1
ERR_SCI_T1_NAD	-2855	NAD error in T1
ERR_SCI_T1_LEN	-2856	LEN error in T1
ERR_SCI_T1_PCB	-2857	PCB error in T1
ERR_SCI_T1_SRC	-2858	SRC error in T1
ERR_SCI_T1_SRL	-2859	SRL error in T1
ERR_SCI_T1_SRA	-2860	SRA error in T1
ERR_SCI_PARAM	-2880	Parameter not allow

15.2 Data Structure

15.2.1 IC card device control block

sci_dcb_t:

```
/* device control block */
struct sci_dcb_t {
            unsigned int voltage;                /* operation condition: voltage */

            /* frequency adjust integer, default value is 372 */
            unsigned int fi;
            /* speed adjust integer, default value is 1 */
            unsigned int di;

            unsigned int conv;                   /* logical converse direction */
            unsigned int protocol;               /* T=0 or T=1 */

            unsigned char option_clock;                  /* stop clock options */
            unsigned char option_voltage;                /* voltage options */
            unsigned char option_spu;

            /* these members are appended, you must notice */
            unsigned int spec;
            unsigned int nego;                           /* support PPS protocol */

            /* the guard time between characters, only for T=0 */
            unsigned int cgt;
            /* block guard time, default value is 22, only for T=1 */
            unsigned int bgt;

            /* RESET signal maintain LOW level clock cycles, default is 42500 */
            unsigned int rstt;

            unsigned int wtt; /* TS wait time, default value is ??? */

            /* allowed maximum of ATR duration, only used in EMV mode
(spec=0) */
            unsigned int twt;
            unsigned int wwt;          /* T=0, work wait time, default is 0x0A */

            /* character repetition (in T=0), maximum is 6 */
            unsigned int tpar_retry;   /* send repeat time on parity error */
            unsigned int rpar_retry;   /* recv repeat time on parity error */

            unsigned int bwt;/* T=1, block wait time, default is 0x00 */
            unsigned int cwt;/* T=1, character wait time, default is 0x05 */

            unsigned char repeat;
            /* the maxium frame size of ICC, default value is 32 */
            unsigned int fsc;
            unsigned int fsd;

            unsigned char sci_last_ipcb;
            unsigned char icc_last_ipcb;

            unsigned char sci_last_pcb;
            unsigned char icc_last_pcb;

            /* reset status: cold reset, warm reset, or activation */
            unsigned int status;
};
```

15.2.2 ATR structure

sci_atr_t:

```
/* ATR */
struct sci_atr_t {
            unsigned char ts;
            unsigned char t0;
            unsigned char ta_flag;
            unsigned char tb_flag;
            unsigned char tc_flag;
            unsigned char td_flag;
            unsigned char ta[8];
            unsigned char tb[8];
            unsigned char tc[8];
            unsigned char td[8];
            unsigned char hbytes[15];
            unsigned char tck;
};
```

15.2.3 APDU Request Structure

ST_ APDU_REQ

```
typedef struct
{
      Unsigned char Cmd[4]; /*CLA, INS, P1, P2*/
      int LC;                        /* The valid length of DataIn sent to ICC */
      unsigned char DataIn[512];/* The data sent to ICC */
      int LE;                             /* The expected returned length */
}ST_ APDU_REQ;
```

NOTE

ST_APDU_REQ structure:

1. LE is the expected return length. . The actual returned length is related to specific command. Here is an expected length but the actual returned length will be obtained by LenOut.
2. LE and LC are used in combination as follows:
   - LC=0, LE=0. There are neither sending data nor return data.
   - LC=0, LE>0. No sending data, but expecting return length. If the expected return length is unknown, set Le to 256; otherwise, set it to a specific value.
   - LC>0, LE=0. The data are sent, but no expected return length.
   - LC>0, LE>0. The data are sent and returned the expected length. . If expected return length is unknown, set Le to 256; otherwise, set it to a specific value.

15.2.4 APDU Response Structure

ST_ APDU_RSP:

```
typedef struct
{
      Int LenOut;                          /* The actual returned data length */
      unsigned char DataOut[512];          /* Returned data pointer from ICC */
      unsigned char SWA;                   /*status word 1 of ICC */
      unsigned char SWB;                   /* status word 2 of ICC */
}ST_ APDU_RSP;
```

15.3 API index

- sci_open ()
- sci_get_dcb ()
- sci_set_dcb ()
- sci_read ()
- sci_write ()
- sci_close ()
- sci_lock ()
- sci_detect ()
- sci_cold_reset ()
- sci_warm_reset ()
- emv_atr_parse ()
- iso7816_atr_parse ()
- iso7816_pps ()
- iso7816_ocs()

● sci_unlock()	● iso7816_t1_ifsd_request()
● sci_powerup()	● iso7816_t0_exchange()
● sci_powerdown()	● iso7816_t1_exchange()

15.3.1 sci_open

Prototype	**int sci_open(int id);**	
Function	Opens the corresponding smartcard device.	
Parameters	id 【Input】	device id
Return	0	opened successfully
	others	failed to open, return an error code
Instruction	Other functions can be operated only after open device successfully.	

15.3.2 sci_get_fd

Prototype	**int sci_get_dcb(int id);**	
Function	Gets the corresponding smartcard device's fd.	
Parameters	id 【Input】	Device id, 0-user slot, 1,2,3,4, sam1-sam4.
Return	>=0	device’s id
	others	device not open or return a error code
Instruction	When open a smartcard device, fd is stored in sci_logical_devices [id].fp, get it by this function.	

15.3.3 sci_get_dcb

Prototype	**int sci_get_dcb(int id, struct sci_dcb_t *dcb)**	
Function	Gets the device control block from the device driver layer.	
Parameters	id 【Input】	device id
	dcb 【Output】	device control block
Return	0	success
	others	error
Instruction		

15.3.4 sci_set_dcb

Prototype	**int sci_set_dcb(int id, struct sci_dcb_t *dcb);**
Function	Sets the device control block to the device driver layer.

Parameters	id【Input】	device id
	dcb【Output】	device control block
Return	0 others	success error
Instruction		

15.3.5 sci_read

Prototype	**int sci_read(int id, unsigned char *pbuf, int length);**	
Function	Reads bytes from the device driver layer.	
Parameters	id【Input】	device id
	pbuf【Output】	data buffer
	length【Input】	data length
Return	0 others	success error
Instruction		

15.3.6 sci_write

Prototype	**int sci_write(int id, unsigned char *pbuf, int length);**	
Function	Writes bytes into the device driver layer.	
Parameters	id【Input】	device id
	pbuf【Output】	data buffer
	length【Input】	data length
Return	0 others	success error
Instruction		

15.3.7 sci_close

Prototype	**int sci_close(int id);**	
Function	Closes the corresponding smartcard device.	
Parameters	id【Input】	device id
Return	0	success

	others	error
Instruction	This function should be called to close device while program exit.	

15.3.8 sci_lock

Prototype	**int sci_lock(int id);**	
Function	Locks the smartcard lock on the corresponding smartcard device.	
Parameters	id【Input】	device id
Return	0 others	success error
Instruction	On smartcard devices, locking the smartcard lock before cold reset, warm reset, reading or writing has no effect on user card device (id = 0).	

15.3.9 sci_unlock

Prototype	**int sci_unlock(int id);**	
Function	Unlocks the smartcard lock on the corresponding smartcard device.	
Parameters	id【Input】	device id
Return	0 others	success error
Instruction	On smartcard devices, unlock the smartcard lock after getting all the data (or error info) from transmission by read operation. It has no effect on user card device (id = 0).	

15.3.10 sci_powerup

Prototype	**int sci_powerup(int id);**	
Function	Card activation on the corresponding smartcard device.	
Parameters	id【Input】	device id
Return	0 others	success error
Instruction		

15.3.11 sci_powerdown

Prototype	**int sci_ powerdown (int id);**	
Function	Card deactivation on the corresponding smartcard device.	
Parameters	id【Input】	device id
Return	0 others	success error

Instruction	

15.3.12 sci_detect

Prototype	**int sci_detect(int id);**	
Function	Detects whether the user card is in the socket or not.	
Parameters	id【Input】	device id
Return	0	success
	others	error
Instruction	Only id = 0 is accepted.	

15.3.13 sci_cold_reset

Prototype	**int sci_cold_reset(int id, struct sci_atr_t *pstATR);**	
Function	Performs a cold reset sequence and receives the ATR data.	
Parameters	id【Input】	device id
	pstATR【Output】	pointer to ATR data
Return	0	success
	others	error
Instruction		

15.3.14 sci_warm_reset

Prototype	**int sci_warm_reset (int id, struct sci_atr_t *pstATR);**	
Function	Performs a warm reset sequence and receives the ATR data.	
Parameters	id【Input】	device id
	pstATR【Output】	pointer to ATR data
Return	0	success
	others	error
Instruction		

15.4 Protocol processing function

15.4.1 emv_atr_parse

Prototype	**int emv_atr_parse (const struct sci_atr_t *pstATR,**

	struct sci_dcb_t *dcb);
Function	Parses the ATR characters according to EMV v4.2 standard.
Parameters	pstATR【Input】 ATR point
	dcb【Output】 device control block
Return	0 success others error
Instruction	

15.4.2 iso7816_atr_parse

Prototype	**int iso7816_atr_parse (const struct sci_atr_t *pstATR, struct sci_dcb_t *dcb);**	
Function	Parses the ATR characters according to ISO7816 standard.	
Parameters	pstATR【Input】	ATR point
	dcb【Output】	device control block
Return	0 others	success error
Instruction		

15.4.3 iso7816_pps

Prototype	**int iso7816_pps(int id, struct sci_atr_t *pstATR, struct sci_dcb_t *dcb);**	
Function	PPS protocol process.	
Parameters	id【Input】	device id
	pstATR【Input】	ATR point
	dcb【Output】	device control block
Return	0 others	success error
Instruction		

15.4.4 iso7816_ocs

Prototype	**int iso7816_ocs(int id, struct sci_atr_t *pstATR);**	
Function	Select operating conditions.	
Parameters	id【Input】	device id

	pstATR【Output】	pointer to ATR data
Return	0 others	success card class selection abort
Instruction	Auto class selection, try 1.8V, then 3V, then 5V.It can be invoked as a cold reset with auto vcc selection.	

15.4.5 iso7816_t1_ifsd_request

Prototype	**int iso7816_t1_ifsd_request(int id);**	
Function	If sd request in T=1.	
Parameters	id【Input】	device id
Return	0 others	success error
Instruction		

15.4.6 iso7816_t0_exchange

Prototype	**int iso7816_t0_exchange(int id, ST_APDU_REQ *apdu_req, ST_APDU_RSP *apdu_resp);**	
Function	Transmission on T=0 protocol under ISO 7816-3 standard.	
Parameters	id【Input】	device id
	apdu_req【Input】	pointer to APDU request, terminal request information
	apdu_resp【Output】	pointer to APDU response, card response information
Return	0 1 others	success success with a warning Error
Instruction		

15.4.7 iso7816_t1_exchange

Prototype	**int iso7816_t1_exchange(int id, ST_APDU_REQ *apdu_req, ST_APDU_RSP *apdu_resp);**	
Function	Transmission on T=1 protocol under ISO 7816-3 standard.	
Parameters	id【Input】	Device id
	apdu_req【Input】	Pointer to APDU request, terminal request

		information.
	apdu_resp【Output】	Pointer to APDU response, card response information.
Return	0 others	success Error
Instruction		

15.5 Encapsulated Interfaces

15.5.1 OsIccOpen

Prototype	**int OsIccOpen(int Slot);**	
Function	Open the ICC reader.	
Parameters	Slot	channel number: ▪ ICC_USER_SLOT User card ▪ ICC_SAM1_SLOT SAM card slot 1 ▪ ICC_SAM2_SLOT SAM card slot 2 ▪ ICC_SAM3_SLOT SAM card slot 3 ▪ ICC_SAM4_SLOT SAM card slot 4
Return	RET_OK ERR_DEV_NOT_EXIST ERR_DEV_BUSY	Success Device does not exist. Device is busy.
Instruction		

CAUTION

1. Other functions can be operated only after successfully opening the IC device.
2. For various machines, the number and types of slot might be different. For specific numbering of slots, please read the manual or consult professional staff.

15.5.2 OsIccDetect

Prototype	**int OsIccDetect(int Slot);**	
Function	Check whether there is a card in the specified slot.	
Parameters	Slot	channel number:
Return	RET_OK Others	Card-inserted Please refer to ICC Return code list
Instruction	1. This function will return immediately no matter whether there is a card in	

	slot or not. 2. For USER_SLOT, if card-insert or card-extract happens, system will send MSG_ICCSIG message to the application which is used to open the device. This mechanism doesn't apply to SAM card.

CAUTION

For SAM card, please make sure call this interface firstly before reset the SAM card. This interface will cause the SAM card to power off.

15.5.3 OsIccInit

Prototype	**int OsIccInit(int Slot, unsigned long Option, unsigned char *Atr);**	
Function	Initialize the IC card device.	
Parameters	Slot	Channel number. Please refer to OslccOpen()
	Option	**(Bit 0~1)card voltage options:** 00 - 5V, 01 - 1.8V, 10 - 3V, 11 - 7V **(Bit 2)Support for PPS protocol:** 0 – not support, 1 – support; **(Bit 3~4)Rate used in ATR** 00 – Standard rate 9600 01 – Twice rate 19200 10 – Four times rate 38400 The rate mentioned here is a reference value which the cards are operated under the typical frequency (3.57MHz) condition The communication rate between the IC card and the reader component is closely related to the working clock frequency which was provided to card by a specific machine. **(Bit 5)Specification** 0 – EMV 1 - ISO7816 If this bit specifically indicates EMV mode, the power rate will be marked as invalid. It uses the standard rate by default. **(Bit 6 ~31)Reserved** Option is set to 0 by default(that is 5V, not PPS, Standard rate, and follow EMVx)
	Atr 【Output】	1. Answer To Reset. Up to 34 bytes will be returned from card.

		2. Content is composed of length of ATR (1 byte) and ATR[output]
Return	RET_OK Others	Success. Please refer to ICC Return code list
Instruction	1. ATR output buffer should be allocated at least 34 bytes. 2. Whether PPS communication coordination protocol is supported or not depends on the specific cards is supported or not. 3. For SAM card, some terminals can only work with one card at a time. If several cards need to be operated at the same time, initialize cards one by one.(OsIccInit ( )) - > operation (OsIccExchange) - > close ( )	

CAUTION

Most of the SAM card only supports ISO7816, so the Option should be set to 0x20, but not 0x00.

15.5.4 OsIccExchange

Prototype	**int OsIccExchange(int Slot, int CtrlFlag, const ST_APDU_REQ *ApduReq, ST_APDU_RSP *ApduRsp);**	
Function	Interacts with IC card using commands.	
Parameters	Slot	Channel number. Please refer to OslccOpen()
	CtrlFlag	1. Bit0 represents whether to send "Get Response" instruction automatically under T=0 protocol. 1 Yes 0 No 2. Bit1~Bit31 Reserved
	ApduReq 【Input】	The data structure sent to IC card.
	ApduRsp 【Output】	The data structure received from IC card.
Return	RET_OK Others	Success. Please refer to ICC Return code list
Instruction		

15.5.5 OsIccClose

Prototype	**int OsIccClose(int Slot);**	
Function	Close the IC card device.	
Parameters	Slot	Channel number. Please refer to OslccOpen()

Return	RET_OK	Success.
	Others	Please refer to ICC Return code list
Instruction		

16 RF Reader

This part mainly describe the applicaton programming interface of contactless IC card reader conforming to the ISO14443 and ‘EMV Contactless Book D V2.1’ regulation.

16.1 Return Code List

Table 14 Return Code List

Macro	Value	Description
PCD_ERR_PAR_FLAG	-2901	Parity error
PCD_ERR_CRC_FLAG	-2902	CRC error
PCD_ERR_WTO_FLAG	-2903	Timeout or no card
PCD_ERR_COLL_FLAG	-2904	several cardscollision.
PCD_ERR_ECD_FLAG	-2905	Frame format error
PCD_ERR_EMD_FLAG	-2906	Interference
PCD_ERR_COM_FLAG	-2907	Chip error, it cannot communicate correctly.
PCD_ERR_AUT_FLAG	-2908	M1 authentication error
PCD_ERR_TRANSMIT_FLAG	-2909	Transmission error

PCD_ERR_PROTOCOL_FLAG	-2910	Protocol error
PCD_ERR_PARAMFILE_FLAG	-2911	Configuration file does not exist
PCD_ERR_USER_CANCEL	-2912	Usercancelled the transaction
PCD_ERR_CARRIER_OBTAIN_FLAG	-2913	Didn't obtain the carrier
PCD_ERR_CONFIG_FLAG	-2914	Configuration register failed
PCD_ERR_NOT_ALLOWED_FLAG	-2951	Parameter error or obtaining value isn't allowed
PCD_CHIP_ABNORMAL	-2952	Chip is abnormal or does not exist
PCD_CHIP_NOT_OPENED	-2953	Module is not open
PCD_CHIP_CARDEXIST	-2954	Card isn't removed
PCD_ERR_NOT_IDLE_FLAG	-2955	Card is not in idle state
PCD_ERR_NOT_POLLING_FLAG	-2956	Card did not do thePOLLING
PCD_ERR_NOT_WAKEUP_FLAG	-2957	Card does not wakeup
PCD_ERR_NOT_ACTIVE_FLAG	-2958	Card is not activated

16.2 Data Structure

About request and response of data structure, please refer to the IC Card Reader section 15.2.3 and 15.2.4.

16.2.1 User Configuration Structure

PCD_USER_ST

```
typedef struct pcd_user_t{
unsigned char wait_retry_limit_w;      /* Written enable for the number
of   S(WTX) response*/
unsigned int wait_retry_limit_val;      /* S(WTX) response to the times that
repeat most frequently.*/
unsigned char check_cancel_key_w;      /*Written enable for checking the
cancel key*/
unsigned char check_cancel_key_val;    /* 0 represents no response to the
```

```
                                        cancel key, 1 represents response the
                                        cancel key */
int (*check_cancel_key_function)(void);/* Check whether has pressed the cancel
                                        key, if set check_cancel_key_w=1 and
                                        check_cancel_key_val=1, the
                                        check_cancel_key_function will be called
                                        during the RF card transaction, when it
                                        returns 0, it represents it hasn't pressed
                                        the cancel key, otherwise, it means it has,
                                        in this case it will be forced to exit the
                                        transaction */
unsigned char reserved[60];   /* Reserved byte, for future expansion */
} PCD_USER_ST;
```

16.2.2 Configuration Parameter Definition

struct PCD_PARAM_ST

```
    /*Card protocol check enable switch,1- check;0 – do not check */
    unsigned int uiProtocolCheckEn;
    /*the maximum block length that the card received .(unit: byte) */
    unsigned int uiFSC;
    /*The longest time that waiting for card response, use the current ETU
    time as a time unit*/
    unsigned int uiFWT;
   /*sending protection time, use the current ETU time as a unit */
    unsigned int uiSFGT;

    /*Electrical conductivity of the A card */
    unsigned int uiTypeAConduct;
    /*Reserved*/
    unsigned int uiReserved;
    /* Receiving   sensitivity of the A card */
    unsigned int uiTypeARxThreshold;
   /* Antenna gain of A card */
   unsigned int uiTypeAGain;

   /* Electrical conductivity of the B card */
    unsigned int uiTypeBConduct;
   /* Modulation depth of B card*/
   unsigned int uiTypeBModulDepth;
```

```
/* Receiving sensitivity of the B card */
unsigned int uiTypeBRxThreshold;
/* Antenna gain of B card */
unsigned int uiTypeBGain;

/* Electrical conductivity of the Felica card */
unsigned int uiFelicaConduct;
/* Modulation depthof Felica card */
unsigned int uiFelicaModulDepth;
/* Receiving    sensitivity of the Felica card */
unsigned int uiFelicaRxThreshold;
/* Antenna gain of Felica card */
unsigned int uiFelicaGain;

/*Reserved for future use. */
unsigned int uiRFU[60];
};
```

16.3 ISO14443 --- Type A

16.3.1 iso14443_3a_req

Prototype	**int iso14443_3a_req(unsigned char *atqa);**	
Function	Sends REQA command to PICC,and receives the ATQA from PICC.	
Parameters	atqa【Output】	The buffer for ATQA,2 bytes
Return	0	Success, the ATQA is valid, consists of two bytes.
	others	Error
Instruction	<EMV Contactless Book D - Contactless Comm Protocol 2.1,section 5.3.2>	

16.3.2 iso14443_3a_wup

Prototype	**int iso14443_3a_wup(unsigned char *atqa) ;**	
Function	Sends WUPA command to PICC and receives the ATQA from PICC.	
Parameters	atqa【Output】	the buffer for ATQA, 2 bytes
Return	0	Success, the ATQA is valid, consisting of two bytes.
	others	Error
Instruction	<EMV Contactless Book D - Contactless Comm Protocol 2.1,section 5.3.2>	

16.3.3 iso14443_3a_antisel

Prototype	**int iso14443_3a_antisel(unsigned char *uid, int uid_ln, unsigned char *sak);**	
Function	Sends ANTICOLLISION command to PICC and receives the UID from PICC.	
Parameters	uid	the unique identifier of PICC
	uid_ln	the length of the unique identifier of PICC
	sak	the last selected command response
Return	0 others	Success. Error
Instruction	▪ < EMV Contactless Book D - Contactless Comm Protocol 2.1, section 5.4.2> ▪ < ISO/IEC 14443-3:2001(E) Section 6.4.3.1 and 6.4.4 >	

16.3.4 iso14443_3a_halt

Prototype	**int iso14443_3a_halt( );**	
Function	Sends HALT command to PICC.	
Parameters	None	
Return	0 Others	Success. Error.
Instruction		

16.3.5 iso14443_3a_rats

Prototype	**int iso14443_3a_rats(unsigned char *ats);**	
Function	Requests answer to selection.(defined by iso14443-4)	
Parameters	ats【Output】	the response from PICC(must be greater than 256 bytes)
Return	0 others	Success. Error
Instruction		

16.4 ISO14443 --- Type B

16.4.1 iso14443_3b_req

Prototype	**int iso14443_3b_req(unsigned char *atqb);**	
Function	Sends REQB command to PICC and receives the ATQB from PICC.	
Parameters	atqb【Output】	The buffer for ATQB, 12 or 13 bytes
Return	0	Success, the ATQB is valid; consisting of 12 or 13 bytes.
	others	Error
Instruction	<EMV Contactless Book D - Contactless Comm Protocol 2.1,section 5.3.2>	

16.4.2 iso14443_3b_wup

Prototype	**int iso14443_3b_wup(unsigned char* atqb);**	
Function	Sends WUPB command to PICC and receives the ATQB from PICC.	
Parameters	atqb【Output】	the buffer for ATQB, 12 or 13 bytes
Return	0	Success, the ATQB is valid; consisting of 12 or 13 bytes.
	others	Error
Instruction	<EMV Contactless Book D - Contactless Comm Protocol 2.1,section 5.3.2>	

16.4.3 iso14443_3b_attri

Prototype	**int iso14443_3b_attri(const unsigned char *pupi, unsigned char* data, int *txr_ln);**	
Function	PCD sends ATTRIB command to PICC and receives the SAK from PICC.	
Parameters	pupi	the picc's uid, 4 bytes
	dat【Input&Output】	higher layer INF.(command and response)
	txr_ln	the number of higher layer INF.
Return	0	Success
	others	Error
Instruction		

16.4.4 iso14443_3b_halt

Prototype	**int iso14443_3b_halt( );**	
Function	Sends HALTB command to PICC.	
Parameters	None	

Return	0 others	Success Error
Instruction		

16.5 Half-duplex transmission protocol

16.5.1 iso14443_4_transfer

Prototype	**int iso14443_4_transfer(unsigned char *src, int tx_ln, unsigned char *des, int *rx_ln);**	
Function	Implements the half duplex communication protocol with ISO14443-4.	
Parameters	src	The data will be transmitted by PCD.
	tx_ln	The number of transmitted data by PCD.
	des	The data will be transmitted by PICC
	rx_ln	The number of transmitted data by PICC.
Return	0 others	Success Error
Instruction		

16.6 Encapsulate Interfaces

16.6.1 OsPiccOpen

Prototype	**int OsPiccOpen(void);**	
Function	Power on the PCD module and make the module enter into the preparatory work state.	
Parameters	None	
Return	0 Others	Success Failed to open device. (Details refer to the return code list.)
Instruction		

16.6.2 OsPiccClose

Prototype	**int OsPiccClose (void);**	
Function	Power off the PCD module.	
Parameters	None	
Return	0 Others	Success Failed. (Details refer to the return code list.)
Instruction		

16.6.3 OsPiccResetCarrier

Prototype	**int OsPiccResetCarrier (void);**	
Function	Reset the carrier wave.	
Parameters	None	
Return	0 Others	Success Failed. (Details refer to the return code list.)
Instruction	When doing the carrier reset operation for RF reader, the card state in the RF field will be changed, no matter what the state is, the card will enter the idle state after calling this interface.	

16.6.4 OsPiccPoll

Prototype	**int OsPiccPoll(char* pcPiccType, unsigned char* pucATQx);**	
Function	Looks for cards, inlcuding the roll polling for type A card and type B card.	
Parameters	pcPiccType【Output】	Card types: ▪ ’A’ - card A ▪ ’B’ - card B
	pucATQx 【Output】	In response to the WUPA commands, a Picc of card A will return an ATQA with a length of 2 bytes. In response to the WUPB commands, a Picc of card B will return an ATQB with a length of 12 bytes.
Return	0 Others	Success. Failed. (Details refer to the return code list.)
Instruction	Mifare card is a special A card, after calling this interface, M card returns as a type of A card.	

16.6.5 OsPiccAntiSel

Prototype	**int OsPiccAntiSel(const char pcPiccType, unsigned char *pucUID,**

	const unsigned char ucATQ0, **unsigned char* pucSAK);**	
Function	Do anti-collision and selection operations for cards.	
Parameters	pcPiccType【Input】	Card types: ▪ ’A’ - card A ▪ ’B’ - card B
	pucUID【Output】	Unique identifier of the card: ▪ Card A-- 4, 7 or 10 bytes, the value of the UID shall be a fixed number or a random number which is dynamically generated by the Picc. ▪ Card B—4 bytes, the value of the pucUID of Type B card shall be fixed number or a random number which is dynamically generated by the Picc.
	ucATQ0【Input】	It is unused.
	pucSAK【Output】	The response data of card while selecting card, it has 1 byte. SAK represents the data that response to the last SELECT command of card A. This parameter is ignored by card B.
Return	0	Success.
	Others	Failed (Details refer to the return code list.)
Instruction	If users want to differentiate between the picc of card A and Mifare card, they can make the distinction by output parameters value of the pucSAK.	

16.6.6 OsPiccActive

Prototype	**int OsPiccActive(const char pcPiccType,** **unsigned char *pucRATS);**	
Function	Activate the card.	
Parameters	pcPiccType【Input】	Card types: ▪ ’A’ –Type A card ▪ ’B’ – Type B card
	pucRATS【Output】	The response data: PucRATS represents the data that responds to RATS command of card A. PucRATS represents the data that responds to ATTRIB command of card B.
Return	0	Success.
	Others	Failed(Details refer to the return code list.)
Instruction	The output data of PucRATS mainly includes the card frame waiting time, buffer size, maximum frame sizes, start-up frame guard time, etc. For details,	

	see the 'EMV Contactless Book D V2.1' in section 5.7 and 6.4.

16.6.7 OsPiccTransfer

Prototype	**int OsPiccTransfer(const unsigned char *pucTxBuff, int iTxLen, unsigned char* pucRxBuff, int *piRxLen);**	
Function	Carry out the transparent transmission/reception in accordance with the half-duplex communication protocol in the ISO14443-4	
Parameters	pucTxBuff【Input】	The data buffer to be transmitted.
	iTxLen 【Input】	The length of data to be transmitted.
	pucRxBuff【Output】	Response data buffer of receiving card.
	piRxLen 【Output】	The length of receiving card's response data.
Return	0	Success
	Others	Failed(Details refer to the return code list.)
Instruction		

16.6.8 OsPiccRemove

Prototype	**int OsPiccRemove (void);**	
Function	In accordance with the EMV mode to remove card.	
Parameters	None	
Return	0	Success
	Others	Failed. (Details refer to the return code list.)
Instruction		

16.6.9 OsMifareAuthority

Prototype	**int OsMifareAuthority(unsigned char *uid, unsigned char blk_no, unsigned chargroup, unsigned char *psw);**	
Function	Verify the Mifare card.	
Parameters	uid 【Input】	Card ID, 4 bytes.
	blk_no 【Input】	Block number
	group 【Input】	Password types, can be evaluated as 'A' or 'B'

	psw 【Input】	Authentication password, 6 bytes.
Return	0 Others	Success. Failed. (Details refer to the return code list.)
Instruction		

16.6.10 OsMifareOperate

Prototype	**int OsMifareOperate (unsigned charucOpCode, unsigned charucSrcBlkNo, unsigned char*pucVal, unsigned char ucDesBlkNo);**	
Function	Do operations of reading and writing block for the specified blocks of Mifare card, and increasing, decreasing or backup the specified data block of Mifare card, and then update it into other specified value block.	
Parameters	ucOpCode 【Input】	▪ 'r' or 'R' represents read operations, ▪ 'w' or 'W' represents write operations, ▪ '+' represents Increase value, ▪ '-' represents Decrease value, ▪ '>' represents transfer /backup operation.
	ucSrcBlkNo【Input】	Specify the visiting block number.
	pucVal【Input/Output】	▪ If it is the read operation, pucVal outputs the block contents, and points to the buffer size of 16 bytes. ▪ If it is the write operation, pucVal inputs the block contents, and points to the buffer size of 16 bytes. ▪ If it is the '+'or '-' operation, pucVal is the first address of buffer, and points to the buffer size of 4 bytes. ▪ If it is the transfer operation, pucVal has no practical meaning, but the incoming pointer must be NULL.
	ucUpdateBlkNo 【Input】	Specify the block number which used to written in the operation result.(while reading and writing block, it is NULL)
Return	0 Others	Success. Failed. (Details refer to the return code list.)
Instruction		

16.6.11 OsPiccInitFelica

Prototype	**int OsPiccInitFelica(unsigned char ucSpeed, unsigned char ucModInvert);**	
Function	Initialize the configuration for the Felica card.	
Parameters	ucSpeed【Input】	Set the transmission rate which is used to interact with card. **1:** 424Kbp **Others:** 212Kbps
	ucModInvert【Input】	Set the FeliCa modulate mode. **1:** forward modulate output; **Others:** reverse modulate output.
Return	0	Success.
Instruction		

16.6.12 OsPiccIsoCommand

Prototype	**int OsPiccIsoCommand(int cid, ST_APDU_REQ *ApduReq, ST_APDU_RSP *ApduRsp);**	
Function	Send the APDU format data and receive response in the specified channel.	
Parameters	cid 【Input】	Used for specifying the logical channel number of the card, its value ranges from 0 to 14, currently the value is 0.
	ApduReq 【Input】	The structure sending to PICC card.
	ApduRsp 【Output】	The response structure returning from PICC card.
Return	0 Others	Success. Failed (Details refer to the return code list.)
Instruction		

16.6.13 OsPiccSetUserConfig

Prototype	**int OsPiccSetUserConfig(PCD_USER_ST *pcd_user_config) ;**	
Function	Set the user configuration.	
Parameters	pcd_user_config 【Input】	User configuration structure
Return	0 Others	Success. Failed (Details refer to the return code list.)
Instruction		

16.6.14 OsPiccGetUserConfig

Prototype	**int OsPiccGetUserConfig(PCD_USER_ST *pcd_user_config);**	
Function	Get the user configuration.	
Parameters	pcd_user_config 【Output】	User configuration structure
Return	0	Success.
	Others	Failed (Details refer to the return code list.)
Instruction		

16.7 Note of touch screen and RF reader programming

It has configured touch screen and RF reader on S300 and S800. When the RF card does the A/B transaction, application developers should note that touch screen cannot be used during the period. The remove card function should be called after finishing the transaction. When operating Mifare card, it must call OsPiccRemove () or OsPiccClose () at last. When operating Felica card, the RF module should be closed at last.

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17 Communication Port

17.1 Data Definition

Table 15 Macro definition list of communication ports

Macro	Value	Description
PORT_COM1	0	UART 1
PORT_COM2	1	UART 2
PORT_COM3	2	UART3
PORT_PINPAD	3	Built-out PinPad
PORT_USBDEV	11	USB device mode port
PORT_USBHOST	12	USB host mode port

Table 16 Return code list of USB port functions

Macro	Value	Description
USB_ERR_NOT_OPEN	-3403	Channel is not open.
USB_ERR_BUF	-3404	Send buffer error.
USB_ERR_NOT_FREE	-3405	No free port.

USB_ERR_NO_CONF	-3411	The device has not completed enumeration and configuration process.
USB_ERR_DISCONN	-3412	The device has been disconnected with the host.
USB_ERR_MEM_SYSTEM	-3413	System memory is abnormal.
USB_ERR_BUSY	-3414	USB system is busy.
USB_ERR_RC_SYSTEM	-3415	The application for system resources is failed.
USB_ERR_DEV_ABSENT	-3416	The device on USB host is absent.
USB_ERR_INVALID	-3417	USB communication state is invalid.

17.2 Communication control

17.2.1 OsPortOpen

Prototype	**int OsPortOpen(int Channel, const char *Attr);**	
Function	Opens communication port and sets communication parameters.	
Parameters	Channel	Please refer to the Macro definition list of communication ports, in S800, PORT_COM2 and PORT_PINPAD can be multiplex used but only one port at a time. While inS920, it only has ports of PORT USBDEV and PORT USBHOST.Please refer to Appendix 4.
	Attr【Input】	When the channel is PORT_USBDEV or PORT_USBHOST, attr does not work and it can be NULL. When the channel is UART port: 1. attr =“9600, 8, n, 1”, it represents that the baud rate is 9600bps; 8 data bits; no parity; 1 stop bit. ‘,’ will be used to separate characters. 2. Baud rate: One of 1200, 2400, 4800, 9600, 19200, 38400, 57600,115200 3. Data bit: 7 or 8; 4. Parity method: o-odd parity; e-even parity; n-no parity 5. Stop bit: 1 or 2
Return	RET_OK	Success.
	ERR_DEV_BUSY	Device is busy.

	ERR_DEV_NOT_EXIST	The port does not exist.
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	1. Other functions can be operated only after opening device successfully. 2. Calling this function will close the functions of software flow control and hardware flow control.	

NOTE

1. The prolin2.4 system uses the USB to start the XCB service by default. When application needs to use the USB or serial port, it should call OsRegSetValue ("persist.sys.xcb.enable", "0") in mian() to close the XCB service in order to avoid the resource conflict.
2. We can start the XCB service in these ways.
   a) Call the OsRegSetValue("persist.sys.xcb.enable", "1") in the main application;
   b) Select a connection way among COM, USB and Network in TM.

17.2.2 OsPortClose

Prototype	**void OsPortClose(int Channel);**	
Function	Closes the specified port.	
Parameters	Channel	Please refer to the Macro definition list of communication ports .
Return	None	
Instruction	This function should be called to close the device while program exit.	

17.2.3 OsPortSend

Prototype	**int OsPortSend(int Channel, const void *SendBuf, int SendLen);**	
Function	Sends data to the specified communication port.	
Parameters	Channel	Please Refer to the Macro definition of communication port
	SendBuf【Input】	Sent data.
	SendLen	Length of sending data.(<=8*1024)

Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	Port is not open.
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	1. The buffer size is 8K, when the sent data is less than the free space of the buffer, this function will not block and the sent data will only be stored in the send buffer. 2. When calling OsPortClose(), the system will block until the send buffer data has been sent out.	

17.2.4 OsPortRecv

Prototype	**int OsPortRecv(int Channel, void *RecvBuf, int RecvLen, int TimeoutMs);**	
Function	Receives data from specified communication port.	
Parameters	Channel	Please Refer to the Macro definition of communication.
	RecvBuf【Output】	Received data buffering.
	RecvLen	The data length that want to receive. When the length is 0, it means clear the receive buffer.
	TimeoutMs	Receive timeouts【unit:ms】 (The minimum precision is 100ms) It should be <= 25500, otherwise, it will return ERR_INVALID_PARAM.
Return	>=0	The actual length of receive data.
	ERR_DEV_NOT_OPEN	Port does not open.
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	1. The received data will return immediately when it is equal to the RecvLen. 2. If did not reach the RecvLen, it will wait for timeouts.	

17.2.5 OsPortReset

Prototype	**int OsPortReset (int Channel);**	
Function	Reset the port. This function will clear all the data in send and receive buffers of COM port.	
Parameters	Channel【Input】	Please Refer to the Macro definition list of communication

		ports.
Return	RET_OK ERR_DEV_NOT_OPEN ERR_INVALID_PARAM	Success Port is not open Invalid parameter
Instruction		

17.2.6 OsPortCheckTx

Prototype	**int OsPortReset(int Channel);**	
Function	Check the remaining bytes in sendbuffer of the specified COM port.	
Parameters	Channel 【Input】	Please Refer to the Macro.
Return	>=0 ERR_DEV_NOT_OPEN ERR_INVALID_PARAM	The data size remained in the send buffer Port is not open Invalid parameter
Instruction		

17.3 POSIX

Prolin opens serial POSIX interfaces for applications developers to use.

The corresponding relation between device node and serial port is shown as below:

Device node	Serial port	The corresponding module	applicable models
/dev/ttyAMA0	modem	modem	S800
/dev/ttyAMA1	wireless	wireless	S800/S900
/dev/ttyAMA2	PORT_COM1	COM1	S800/S900/S300/D200
/dev/ttyAMA3	PORT_PINPAD	pinpad	S800
/dev/ttyhost	PORT_USBHOST	usb	S800/S900/S300/D200
/dev/ttydev	PORT_USBDEV	usb	S800/S900/S300/D200

Concrete operations as follow:

17.3.1 Open

Opens the uart, and the device name are ttyAMA0, ttyAMA1, ttyAMA2, ttyAMA3.

```
int fd;
/* Open the uart with read-write access mode*/
fd = open("/dev/ttyAMA1", O_RDWR);
if(-1 == fd){
    perror ("Open uart error!");
}
```

17.3.2 Read

Read data from communication port.

char buff [1024];

int Len = 1024;

int readByte = read (fd, buff, Len);

17.3.3 Write

Write data to the communication port. (send)

char buffer [1024];

int Length = 1024;

int nByte;

nByte = write (fd, buffer, Length);

17.3.4 Close

Close communication port.

close(fd);

17.3.5 Query the buffer data of communication port

```
int remain;
int count;
/* Inquiry the number of bytes remained in send buffer */
ioctl(fd, TIOCOUTQ, &remain);
/* Inquiry the number of bytes which remained in receive buffer */
ioctl(fd, TIOCINQ, &count);
```

17.3.6 Clear the buffer data of communication port

```
/* clear the buffer data*/
tcflush(fd, TCIOFLUSH);
```

17.3.7 Set the configuration parameters of communication port

```
/* Set the baud rate, data bits, parity bits and stop bits of uart*/
int SetTermios (int fd, int nSpeed, int nBits, char cEvent, int nStop)
{
    struct termios newtio, oldtio;

    /* Get configurations of the original uart */
    if (tcgetattr (fd, &oldtio) != 0)
        {
            printf("Get serial error\n");
            return -1;
        }

    /* Initialize the variable of new configuration */
    bzero (&newtio, sizeof (newtio));
    newtio.c_cflag |= CLOCAL | CREAD;
    newtio.c_cflag &= ~CSIZE;

 /* close soft flow control*/
   newtio.c_iflag &= ~(ICRNL | IXON | IXOFF);

  /* close hard flow control*/
  newtio.c_cflag &= ~CRTSCTS;

    /* set the data bits */
    switch (nBits)
        {
        case 7:
            newtio.c_cflag |= CS7;
            break;
        case 8:
            newtio.c_cflag |= CS8;
            break;
        }

    /* Configurate the parity bit*/
```

```
switch (cEvent)
   {
   case 'o':
      newtio.c_cflag |= PARENB;
      newtio.c_cflag |= PARODD;
      newtio.c_iflag |= (INPCK | ISTRIP);
      break;
   case 'e':
      newtio.c_iflag |= (INPCK | ISTRIP);
      newtio.c_cflag |= PARENB;
      newtio.c_cflag &= ~PARODD;
      break;
   case 'n':
      newtio.c_cflag &= ~PARENB;
      break;
   }

/* Set the baud rate*/
switch (nSpeed)
   {
   case 1200:
      cfsetispeed (&newtio, B1200);
      cfsetospeed (&newtio, B1200);
   case 2400:
      cfsetispeed (&newtio, B2400);
      cfsetospeed (&newtio, B2400);
      break;
   case 4800:
      cfsetispeed (&newtio, B4800);
      cfsetospeed (&newtio, B4800);
      break;
   case 9600:
      cfsetispeed (&newtio, B9600);
      cfsetospeed (&newtio, B9600);
      break;
   case 19200:
      cfsetispeed (&newtio, B19200);
      cfsetospeed (&newtio, B19200);
      break;
   case 38400:
      cfsetispeed (&newtio, B38400);
```

```
            cfsetospeed (&newtio, B38400);
            break;
        case 57600:
            cfsetispeed (&newtio, B57600);
            cfsetospeed (&newtio, B57600);
            break;
        case 115200:
            cfsetispeed (&newtio, B115200);
            cfsetospeed (&newtio, B115200);
            break;
        default:
            printf ("Not support the speed %d\n", nSpeed);
            cfsetispeed (&newtio, B9600);
            cfsetospeed (&newtio, B9600);
            return -1;
        }

    /* set the stop bits */
    if (nStop == 1)
        newtio.c_cflag &= ~CSTOPB;
    else if (nStop == 2)
        newtio.c_cflag |= CSTOPB;

    /* Set the waiting time and the minimum number of characters, there is no
specific request for waiting time and receive characters ,and it can be set to 0
*/
    newtio.c_cc[VTIME] = 0;
    newtio.c_cc[VMIN] = 0;

    /* Clear the send buffer*/
    tcflush (fd, TCIFLUSH);

    /* Set the new configuration message */
    if ((tcsetattr (fd, TCSANOW, &newtio)) != 0)
        {
            printf("Set serial error\n");
            return -1;
        }
    return 0;
}
```

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18 MODEM

In Prolin, it can use the built-in UART to send AT commands to Modem and implement the Modem communication functions; at the same time, it can encapsulate some Modem communication interfaces for the developers to use.

18.1 Return code list

Table 17 Modem return code list

Macro	Value	Description
MODEM_CONNECTING	10	Dialing
MODEM_CONNECTED	0	Connected
MODEM_HAVE_DIALED	6	Start sending numbers (only from automatically sending mode to manually answering mode)
MODEM_RECV_POOL_HAVE_DATA	8	Receive buffer is not empty (received remote data)
MODEM_RECVDATA_SEND_IS_FULL	9	Receive buffer is not empty, the send buffer is full.
MODEM_SEND_POOL_FULL	1	Send buffer is full. (In OsModemCheck(), the full

		status of send buffer represents that the modem is using the send buffer, at this time, the OsModemSend() cannot be used.)
MODEM_IDLE	11	Idle
ERR_MDM_TXOVER	-3100	Sending buffer full. (presents return error. If synchronize, it means the system is using the send buffer; If asynchronize, it means the send buffer is full.)
ERR_MDM_BYPASS_BUSY	-3101	The paralleled line is busy. The hardware of NGFP S800 has no side telephone port, and also no such return value.
ERR_MDM_LINE_BUSY	-3102	Telephone line is not properly connected, or parallel line is occupied.
ERR_MDM_NO_CARRIER	-3103	Carrier wave of telephone lost. (Built synchronization chain failure)
ERR_MDM_NO_ANSWER	-3104	No response for dialing.
ERR_MDM_CALLEE_BUSY	-3105	Line busy.
ERR_MDM_NO_LINE	-3106	Telephone line is not connected (Line voltage is 0).
ERR_MDM_CMD_BUF_FULL	-3108	The excommand() buffer is full.
ERR_MDM_CMD_TOO_LONG	-3109	Command of excommand() is too long, exceeded 100.
ERR_MDM_CMD_NOT_SUPPORT	-3110	Excommand() does not support the command.
OTHERS	-3XXX (-3111 ~ -3199	Abnormal error code doesn't appear frequently in practice. Setting abnormal error code is for the purpose of maintainability. Details about

	)	what error code means are not important.
	-3115	Calling synchronization handshake receiving process 1 error
	-3116	Calling synchronization handshake receiving data package error.
	-3117	Calling synchronization handshake receiving package type error.
	-3118	Calling synchronization handshake receiving process 2 error
	-3119	Calling synchronous communication receiving process 1 error
	-3120	Calling synchronous communication chip hang up
	-3121	Calling synchronous communication receiving packet series number error
	-3122	Calling synchronous communication receiving process 2 error
	-3123	Calling synchronous communication sent overload
	-3124	Calling synchronous communication sent under load.
	-3130	Calling synchronous communication line rate is illegal.
	-3131	Calling synchronous communication send state packet 1 errors

-3132	Calling synchronous communication sent data packets retry more than the specified time.
-3133	Calling synchronous communication sent data packets timeout
-3134	Calling synchronous communication receiving the acknowledgement packet retry more than the specified time
-3135	Calling synchronous communication sent stateful packet 2 error
-3136	Calling synchronous communication sent stateful packet 3 error
-3137	Calling synchronous communication sent stateful packet 4 error
-3138	Calling synchronous communication receiving data packets retry more than the specified time
-3139	Calling synchronous communication sent stateful packet 5 error
-3140	Calling synchronous communication sent stateful packet 6 error
-3144	Sent number automatically and not to pick up the phone timely.
-3145	Called synchronization handshake sent handshake packets failed

	-3146	Called synchronization handshake receiving handshake packets failed
	-3147	Called synchronization handshake more than the specified time.
	-3148	Called synchronous communication sent stateful packet 1 error
	-3149	Called synchronous communication receiving process 1 error
	-3150	Called synchronous communication chip hang up
	-3151	Called synchronous communication receiving process 2 error
	-3152	Called synchronous communication receiving retry more than the specified time
	-3153	Called synchronous communication sent stateful packet 2 error
	-3154	Called synchronous communication sent data packet error
	-3155	Called synchronous communication receiving process 3 error
	-3156	Called synchronous communication receiving the packet retry more than the specified time
	-3157	Called synchronous communication sent stateful packet 3 error

	-3160	Called connection receiving ring information error
	-3161	Called connection detecting the line voltage failed
	-3162	Called connection detecting the line voltage data format error
	-3163	Called connection voltage is less than the threshold
	-3164	Called connection timeout
	-3165	Called asynchronous line rate format is incorrect
	-3166	Called asynchronous line rate is illegal.
	-3167	Called connection information format is incorrectly.
	-3170	Called connection set the instruction string 1 failed
	-3171	Called connection set the instruction string 2 failed
	-3172	Called connection set the extended instruction string failed
	-3175	Calling connection set instruction string 1 failed.
	-3176	Calling connection set instruction string 2 failed.
	-3177	Calling connection set instruction string 3 failed.
	-3178	Calling connection set instruction string 4 failed.
	-3180	Calling connection set instruction string 5 failed.

	-3181	Calling connection asynchronous line rate is illegal
	-3182	Calling connection set instruction string 6 failed.
	-3183	Calling connection set extended instruction string failed
	-3185	Calling connection has no dial tone.
	-3186	Calling connection chip indicate an error.
	-3187	Calling connection detect the digital lines.
	-3188	Calling connection has no dial tone and the voltage is too low.
	-3189	Calling connection has other exception errors.
	-3192	Non-pre-dial-up dial up timeout (300s)
	-3193	When FSK sends data, the DCD signal timeout
	-3194	When FSK sends data, the CTS signal timeout
	-3195	FSK sends data timeout.
	-3196	Called synchronous communication sent data packet format error
	-3197	Asynchronous communication does not support the Connect Format parameters
	-3198	Daemon to create thread failed

	-3199	The process with Daemon communication failure or error
	-3200	Modem is using the bound uart.
	-3201	Socket creation failed
	-3202	Socket link failed
	-3203	Socket send failed
	-3204	Create semaphore failed
	-3205	Set the semaphore value failed
	-3206	Semaphore has been pre-empted.
	-3207	Semaphore cannot be released.
	-3208	Semaphore initialization failed
	-3209	Failed to get time of the day.
	-3210	More than 2 links are using the modem daemon
	-3211	Received the cancel button in the dial-up process.
	-3212	The request of receiving data is rejected. (Receive buffer is empty.)
	-3213	The command string 7 of calling connection Setting is failed.
	-3214	The command string 8 of calling connection Setting is failed.
	-3215	FSK sending is overtime, but still has data in send buffer.
	-3216	Invalid data length (len=0 or len>2048), will not send data.

ERR_MDM_INIT	-3217	Modem initialization failed.
	-3218	If does not implement OsModemConnect(), or implemented OsModemConnect() wrongly, then implement OsPppomLogin() or OsPppomCheck().
	-3219	The Modem or ModemPPP is being used, Modem cannot be powered off.
	-3220	Modem does not power on.

18.2 Data structure

ST_MODEM_SETUP:

```
typedef struct {


    int CallMode;
    int CommMode;
    int CodeType;
    int CodeDuration;
    int CodeSpacing;
    int DetectLineVoltage;
    int DetectDialTone;
    int DialToneTimeout;
    int CommaPauseTime;
    char ConnectRate[20];
    char ConnectFormat[20];
    int ConnectTimeout;
    int DialTimes;
    int IdleTimeout;
    int Pppom;


    int Reserved[9];

}ST_MODEM_SETUP;
```

Table 18 Variable definition of ST_MODEM_SETUP

CallMode	MODEM_PRE_DIAL	Caller pre-dial
	MODEM_DIAL	Caller dial
	MODEM_WAIT_CALL	Called/Answered the call
CommMode	MODEM_COMM_SYNC	synchronous
	MODEM_COMM_ASYNC	asynchronous
CodeType	MODEM_CODE_DTMF	DTMF(Dual Tone Multi Frequency) dialing
	MODEM_CODE_PULSE1	Pulse dialing 1(Pulse rate 10/s; Intermittent proportion 1.6:1;Signal interval>=500ms)
	MODEM_CODE_PULSE2	Pulse dialing 2(Pulse rate 10/s; Intermittent proportion 2:1; Signal interval >=600ms)
	Other values	Reserved
CodeDuration	The duration of two-tone dialing a single number (Unit:10ms,valid range 5~25)	
CodeSpacing	The interval time between two numbers of two-tone dial-up. It cannot be set to any value in 93011 chip, and it is not applicable to S800. (Unit:10ms, valid range 5~25)	
DetectLineVoltage	TRUE	Detect the parallel telephone occupation (Caller dialing, No assigned number switch to manual answer mode)
	FALSE	Doesn't not detect the parallel telephone occupation (Caller dialing, if there is no assigned number, switch to manual answer mode)
DetectDialTone	TRUE	Dial tone detection. Refer to the instruction of DailTone Timeout.

	FALSE	Does not detect dial tone. If the 8th bit of DetectDialTone is 1(0x80), while set is called, it will not postback in 8s and the drive will send 15 to client, or the drive will postback 15 to client.
DialToneTimeout	Dial tone detection: The longest time to wait for the dial tone. Exit waiting when the dial tone has been detected during this time. Dial tone not detected: The waiting time for dial tone when hang up machine. Unit: 100ms, both the minimum value and default value are 20, valid range is 20~50. In both cases, waits 450 to 500ms to start starts the timer after hanging up the machine.	
CommaPauseTime	“,”wait time when dial outside line (Unit: 100ms). This value will be set according to the actual application environment. It is better to keep interface of manually setting in the application. (Range is 0~255. The range is not applicable to S800) The valid range of S800 is 1~26s (Because of the modem patch, it is inconsistent with the Datasheet)	
ConnectRate[20]	The rate of connection and communication(Expressed as a string): “1200”//1200 bps fast connect “1200,V22”//1200 bps normal connect “1200,V23C”//1200 bps for V.23C(FSK) “1200,B202”//1200 bps for Bell 202(FSK) “2400,FC”//2400 bps fast connect “2400”//2400 bps normal connect “4800”//4800 bps “7200”//7200 bps	

	"9600"//9600 bps "12000"//12000 bps "14400"//14400 bps "19200"//19200 bps "24000"//24000 bps "26400"//26400 bps "28800"//28800 bps "31200"//31200 bps "33600"//33600 bps "48000"//48000 bps "56000"//56000 bps For null string "\ 0"and synchronous communication, the system will select "1200" by default. For asynchronous communication, the system will by default select the maximum rate that the chip can support. S800 supports the baud rate. Asynchronous: "1200"//1200 bps "1200,V23C"//1200 bps for V.23C(FSK) "1200,B202"//1200 bps for Bell 202(FSK) "2400"//2400 bps "4800"//4800 bps "7200"//7200 bps "9600"//9600 bps "12000"//12000 bps

	“14400”//14400 bps “19200”//19200 bps “24000”//24000 bps “26400”//26400 bps “28800”//28800 bps “31200”//31200 bps “33600”/33600 bps “48000”//48000 bps “56000”//56000 bps Synchronous: “1200”//1200 bps “1200,V22”//1200 bps normal connect “2400,FC”//2400 bps fast connect “2400”//2400 bps “9600”//9600 bps
ConnectFormat[20	Format of connection and communication(Expressed as a string): “8, n, 1” “8, e, 1” “8, o, 1” “7, e, 1” “7, o, 1” For null string "\ 0", the system will select“8, n, 1” by default. For Synchronous communication, the system will select“8, n, 1” automatically.
ConnectTimeout	Timeouts of waiting for connection,【unit: s】,(valid range 0~300)

DialTimes	The total number of dial-up cycle (convert 0 to 1 if it is 0). Dialing all the numbers in a dial number string is one cycle (valid range is 1~255).	
IdleTimeout	There is no application-layer data exchange in the specified time. MODEM then will hang up. Use 10s as a unit., no timeout if it is 0. The maximum timeout is 900s.This value is invalid to Modem PPP.	
Pppom	TRUE	Modem PPP communication
	FALSE	Common communication
Reserved[9]	Reserved.	

18.3 OsModemOpen

Prototype	**int OsModemOpen(void);**	
Function	Switches on the Modem device.	
Parameters	None	
Return	RET_OK	Success
	ERR_DEV_NOT_EXIST	Device does not exist.
	ERR_DEV_BUSY	Device is busy.
	ERR_NO_PORT	No communication port.
Instruction	Other functions can be operated only after opening the device successfully. It should call the OsModemSwitchPower() to power on the device before using the Modem.	

18.4 OsModemClose

Prototype	**void OsModemClose(void);**	
Function	Switches off the Modem device.	
Parameters	None	
Return	None	
Instruction	This function can only close the modem that is opened by the local application. When the modem device is not open, this function can't do any operation.	

18.5 OsModemSwitchPower

Prototype	**int OsModemSwitchPower(int OnOff);**	
Function	Manages the Modem Power.	
Parameters	int OnOff	OnOff=1, power on,

		OnOff=0, power off.
Return	RET_OK	Success
	-3219	The Modem or ModemPPP is being used, Modem cannot be power off.
	-3220	Modem does not power on.
Instruction	1. It should power on the Modem before using Modem or ModemPPP. 2. This function is independent of the interface functions in Modem module. 3. It will not automatically perform OsModemClose() when Modem module is powered off.	

18.6 OsModemConnect

Prototype	**int OsModemConnect(const ST_MODEM_SETUP *Setup,** **const unsigned char *TelNo);**	
Function	Sets the communication link function, for both calling and being called.	
Parameters	Setup【Input】	Modem parameter. While mdm_setup==NULL, default dialing parameter will be used. Default dialing mode includes: Synchronous, 1200, DTMF, connection timeout for 10 seconds, idle hang up for 60 seconds.
	TelNo【Input】	Telephone number.
Return	RET_OK	Success
	ERR_MDM_BYPASS_BUSY	The paralleled line is busy.
	ERR_MDM_LINE_BUSY	Telephone line is not properly connected, or parallel line is occupied.
	ERR_MDM_NO_ANSWER	No response for dialing.
	ERR_MDM_CALLEE_BUSY	Line is busy.
	ERR_MDM_NO_LINE	Telephone line is not connected (Line voltage is 0).
	ERR_MDM_NO_CARRIER	Carrier wave of telephone lost.
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_MDM_CANCEL_KEY_DOWN	Press CANCEL key while dialing.
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	1. The function can also be used to set Modem mode to being called. 2. Telephone icon will be controlled by a program. It shows hang-up icon while connecting; it shows pickup icon when communication is established, or during switching time of pre-dial after hang-up.	

	3. It needs to call the OsModemCheck() to query the result of pre-dial. 4. It must call OsModemConnect() before using the ModemPPP, sets ST_MODEM_SETUP.Pppom=1, and it doesn't need to call OsModemOpen (), then calls OsPppomLogin().

NOTE

Meanings of telephone symbols:

0-9,*, #,A~D — Telephone numbers

, — Dialing delay

; — Transmitting next telephone number

. — End of numbers, which is used to keep connected with application after sending numbers

.. — End of extension numbers, which is used to switch to manual receiving after sending numbers.

18.7 OsModemCheck

Prototype	**int OsModemCheck(void);**	
Function	Checks the status of Modem and telephone line.	
Parameters	None	
Return	MODEM_CONNECTING	Dialing
	MODEM_CONNECTED	Connected
	MODEM_IDLE	Idle
	ERR_MDM_BYPASS_BUSY	The parallel line is busy.
	ERR_MDM_LINE_BUSY	Telephone line is not properly connected, or parallel line is occupied.
	ERR_MDM_NO_ANSWER	No response for dialing.
	ERR_MDM_CALLEE_BUSY	Line busy.
	ERR_MDM_NO_LINE	Telephone line is not connected (Line voltage is 0).
	ERR_MDM_NO_CARRIER	Carrier wave of telephone lost.
	ERR_MDM_RECVPOOL_NOT_EMPTY	Receive buffer is not empty(received remote data)
	ERR_MDM_RECVPOOL_SENDPOOL_BOTH_NOT_EMPTY	Receive buffer is not empty (received remote data), and the send buffer is sending data.
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	1. This function can be used to check whether communication has been established or not by the pre-dial. 2. After calling OsModemOpen(), OsModemHangup() or OsModemClose(), the status of the last Modem dial will become: MODEM_IDLE.	

18.8 OsModemExCmd

Prototype	**int OsModemExCmd(const char *Cmd, char *Rsp, int *RespLen, int TimeoutMs);**	
Function	Sets additional AT control command for OsModemConnect() to control the connection behavior of Modem dialing.	
Parameters	Cmd 【Input】	Input AT control command.
	Rsp 【Output】	Contents of response data.
	RespLen 【Output】	Length of response data.
	TimeoutMs	Waiting time for response.(unit:ms)
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_MDM_CMD_BUF_FULL	Command buffer overflow.
	ERR_MDM_CMD_TOO_LONG	Command is too long.
	ERR_MDM_CMD_NOT_SUPPORT	Does not support the command. (command that begin with AT,S3,S7,WT=)
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	1. The function is needed to be called before OsModemConnect(), and it is only valid for the entire process of OsModemConnect(). 2. While the function is executing, it will automatically hang up current dialing or communication process. 3. The function can be called 100 times continuously. If it is more than 100, the exceeding callings will be discarded and report error.	

CAUTION

1. Maximum 100 bytes of string can be inputted for each calling. If it is more than 100 bytes, the entire control command will be discarded and report error.
2. Every input of control command has to be AT control command supported by this Modem chip. Otherwise, it will lead to OsModemConnect( ) failure.

18.9 OsModemHangup

Prototype	**void OsModemHangup(void);**	
Function	Hangs up Modem or terminates Modem dialing.	
Parameters	None	
Return	None	
Instruction	If dialing the number again right after hanging up, the Modem will wait and start redialing after 3 seconds in order to allow PABX finish hanging up and transmitting dialing tone.	

18.10OsModemSend

Prototype	**int OsModemSend(const void *SendBuf, int SendLen);**	
Function	Sends packets out through Modem.	
Parameters	SendBuf【Input】	Pointer of packets, which will be sent
	SendLen	Length of packets, which will be sent (bytes)
Return	RET_OK	Success
	ERR_NOT_CONNECT	Not connected.
	ERR_MDM_TXOVER	Send buffer is full.
	ERR_MDM_NO_CARRIER	No carrier waves.(Disconnected)
	ERR_INVALID_PARAM	Invalid parameter
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	It can send 2048 bytes each time at most. Receiving and sending data of synchronous called are up to 2053 bytes, because there are more than 5 control characters.	

18.11OsModemRecv

Prototype	**int OsModemRecv(void *RecvBuf, int BufSize, int Timeout);**

Function	Receives packets by MODEM.	
Parameters	RecvBuf 【Output】	Pointer of the packets that have been received. [Buffer size can be defined according to the requirements of different cases.]
	BufSize	Size of RecvBuf (<=2048bytes)
	Timeout	Timeouts【ms】
Return	>= 0	The actual number of receiving data.
	ERR_NOT_CONNECT	Not connected.
	ERR_MDM_NO_CARRIER	No carrier waves.(Disconnected)
	ERR_INVALID_PARAM	Invalid parameter
	ERR_DEV_NOT_OPEN	Device is not open.
Instruction	1. It can receive 2048 bytes each time at most. Receiving and sending data of synchronous called are up to 2053 bytes, because it has 5 more control characters. 2. If the size of actual data is not larger than the specified size of receive buffer, it will return immediately. 3. While receiving data, if there’s a line error, it will immediately return the corresponding error code. 4. For SDLC synchronous communication, it will immediately return after receiving a packet.(even if the received packet length is less than the BufSize) 5. For asynchronous communication, it will immediately return after receiving byte data of BufSize, or wait until the timeout. 6. For synchronous receiving, it will receive a complete frame each time, and it is not limited by BufSize. 7. For FSK, the timeout does not work.	

18.12OsPppomLogin

Prototype	**int OsPppomLogin(const char *Name const char *Password, long Auth, int TimeOutMs);**	
Function	Establishes the Modem PPP network link.	

Parameters	Name 【Input】	User name;
		Length<=50 bytes;
		It cannot be NULL.
		For the 96169 background of ChinaTelecom, it can enter any user name, and it must enter a character at

		least.
	Password 【Input】	Password; Length<=50 bytes;; It cannot be NULL. For the 96169 background of ChinaTelecom, it can enter any password, and it must enter a character at least.
	Auth	Authentication Algorithms; Currently the following Authentication algorithms are supported PPP_ALG_PAP | 0x1 | PAP Authentication Algorithm PPP_ALG_CHAP | 0x2 | CHAP Authentication Algorithm PPP_ALG_MSCHAPV1 | 0x4 | MSCHAPV1 Authentication Algorithm PPP_ALG_MSCHAPV2 | 0x8 | MSCHAPV2 Authentication Algorithm PPP_ALG_ALL | 0xff | All Authentication Algorithms At least one type of authentication algorithm has to be selected, more than one authentication algorithm will also be allowed by using (+) or (|), for example, PPP_ALG_PAP| PPP_ALG_CHAP. If the algorithm is unknown, fill with parameter PPP_ALG_ALL.
	TimeOutMs	Timeouts【unit:ms】; The valid range is 0~3600000. If timeout is <0, it will automatically be set to 0. If more than 360000. It will automatically be set to 3600000.
Return	PPP_LOGINING	In process
	RET_OK	The link established successfully.
	ERR_INVALID_PARAM	Invalid parameter
	ERR_NET_PASSWD	wrong password
	ERR_NET_SERVER_BUSY	Server is busy, communication failed.
Instruction	1. Before using this function, call OsModemConnect() first and set the ST_MODEM_SETUP.Pppom to 1, also it doesn't need to call OsModemOpen(); 2. TimeOutMs=0 means return immediately, 3. Call OsPppomCheck() to check the link status 4. The login time may vary from settings to settings of ST_MODEM_SETUP parameters. The modem chip of S800 supports up to 33600 asynchronous	

	baud rate, dial-up while the setting is less than or equal to 33600, there will be a low re-training rate and high success rate. 5. For the 96169 background (Guidway A8010), if a re-training is occurred and the time period after sending number is more than 20 seconds, then the background communication will no longer confirm to ppp protocol, which will end up in failure. 6. After the link has been set up successfully, it can communicate through the IP network communication function. 7. In the process of dialing, when users want to hang up by pressing the cancel button, the methods of operation are as follows: Application porting a thread and take the key, if it is the cancel key, perform OsPppomLogin ("a", "a", 1, -1), the first 3 parameters should be filled in accordance with the requirements, and the fourth parameter must be set to -1, then ModemPPP will hang-up and automatically logout.

18.13OsPppomCheck

Prototype	**int OsPppomCheck(void);**	
Function	Checks the link status of Modem network.	
Parameters	None	
Return	PPP_LOGOUTING	In disconnection state
	PPP_LOGINING	In process
	RET_OK	Established the link successfully.
	ERR_NET_PASSWD	wrong password
	ERR_NET_LOGOUT	Already called OsPppomLogout() to disconnect the link.
	ERR_NET_IF	Link has been disconnected.
Instruction		

18.14OsPppomLogout

Prototype	**int OsPppomLogout(void);**	
Function	Exits network, disconnect the Modem PPP link.	
Parameters	None	
Return	RET_OK	Success
Instruction		

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19 Network Communication

Prolin uses the unified TCP/IP stack to manage different physical connections. For the network communications programming, it provides a standard socket programming (socket).

19.1 TCP programming

```
/* Server code in C */

   #include <sys/types.h>
   #include <sys/socket.h>
   #include <netinet/in.h>
   #include <arpa/inet.h>
   #include <stdio.h>
   #include <stdlib.h>
   #include <string.h>
   #include <unistd.h>

   int main(void)
   {
      struct sockaddr_in stSockAddr;
      int SocketFD = socket(PF_INET, SOCK_STREAM, IPPROTO_TCP);
```

```
        if(-1 == SocketFD)
        {
            perror("cannot create socket");
            exit(EXIT_FAILURE);
        }

        memset(&stSockAddr, 0, sizeof(stSockAddr));

        stSockAddr.sin_family = AF_INET;
        stSockAddr.sin_port = htons(1100);
        stSockAddr.sin_addr.s_addr = INADDR_ANY;

        if(-1 == bind(SocketFD,(struct sockaddr *)&stSockAddr,
sizeof(stSockAddr)))
        {
            perror("error bind failed");
            close(SocketFD);
            exit(EXIT_FAILURE);
        }

        if(-1 == listen(SocketFD, 10))
        {
            perror("error listen failed");
            close(SocketFD);
            exit(EXIT_FAILURE);
        }

        for(;;)
        {
            int ConnectFD = accept(SocketFD, NULL, NULL);

            if(0 > ConnectFD)
            {
                perror("error accept failed");
                close(SocketFD);
                exit(EXIT_FAILURE);
            }

            /* perform read write operations ...
            read(ConnectFD,buff,size)*/
```

```
          if (-1 == shutdown(ConnectFD, SHUT_RDWR))
          {
             perror("cannot shutdown socket");
             close(ConnectFD);
             exit(EXIT_FAILURE);
          }
          close(ConnectFD);
       }
return EXIT_SUCCESS;
}

   /* Client code in C */

   #include <sys/types.h>
   #include <sys/socket.h>
   #include <netinet/in.h>
   #include <arpa/inet.h>
   #include <stdio.h>
   #include <stdlib.h>
   #include <string.h>
   #include <unistd.h>

   int main(void)
   {
      struct sockaddr_in stSockAddr;
      int Res;
      int SocketFD = socket(PF_INET, SOCK_STREAM, IPPROTO_TCP);

      if (-1 == SocketFD)
      {
         perror("cannot create socket");
         exit(EXIT_FAILURE);
      }

      memset(&stSockAddr, 0, sizeof(stSockAddr));

      stSockAddr.sin_family = AF_INET;
      stSockAddr.sin_port = htons(1100);
      Res = inet_pton(AF_INET, "192.168.1.3", &stSockAddr.sin_addr);
```

```
        if (0 > Res)
        {
            perror("error: first parameter is not a valid address family");
            close(SocketFD);
            exit(EXIT_FAILURE);
        }
        else if (0 == Res)
        {
            perror("char string (second parameter does not contain valid
ipaddress)");
            close(SocketFD);
            exit(EXIT_FAILURE);
        }

        if (-1 == connect(SocketFD, (struct sockaddr *)&stSockAddr,
sizeof(stSockAddr)))
        {
            perror("connect failed");
            close(SocketFD);
            exit(EXIT_FAILURE);

        }

        /* perform read write operations ... */

        shutdown(SocketFD, SHUT_RDWR);

        close(SocketFD);
        return EXIT_SUCCESS;
    }
```

19.2 UDPprogramming

```
#include <stdio.h>
#include <errno.h>
#include <string.h>
#include <sys/socket.h>
#include <sys/types.h>
#include <netinet/in.h>
```

```
#include <unistd.h> /* for close() for socket */
#include <stdlib.h>

int main(void)
{
   int sock = socket(PF_INET, SOCK_DGRAM, IPPROTO_UDP);
   struct sockaddr_in sa;
   char buffer[1024];
   ssize_t recsize;
   socklen_t fromlen;

   memset(&sa, 0, sizeof sa);
   sa.sin_family = AF_INET;
   sa.sin_addr.s_addr = INADDR_ANY;
   sa.sin_port = htons(7654);
   fromlen = sizeof(sa);

   if (-1 == bind(sock,(struct sockaddr *)&sa, sizeof(sa)))
   {
      perror("error bind failed");
      close(sock);
      exit(EXIT_FAILURE);
   }

   for (;;)
   {
      printf ("recv test....\n");
      recsize = recvfrom(sock, (void *)buffer, sizeof(buffer), 0, (struct sockaddr
*)&sa, &fromlen);
      if (recsize < 0) {
         fprintf(stderr, "%s\n", strerror(errno));
         exit(EXIT_FAILURE);
      }
      printf("recsize: %z\n ", recsize);
      sleep(1);
      printf("datagram: %.*s\n", (int)recsize, buffer);
   }
}

#include <stdlib.h>
#include <stdio.h>
```

```
#include <errno.h>
#include <string.h>
#include <sys/socket.h>
#include <sys/types.h>
#include <netinet/in.h>
#include <unistd.h>
#include <arpa/inet.h>

int main(int argc, char *argv[])
{
   int sock;
   struct sockaddr_in sa;
   int bytes_sent;
   char buffer[200];

   strcpy(buffer, "hello world!");

   sock = socket(PF_INET, SOCK_DGRAM, IPPROTO_UDP);
   if (-1 == sock) /* if socket failed to initialize, exit */
      {
         printf("Error Creating Socket");
         exit(EXIT_FAILURE);
      }

   memset(&sa, 0, sizeof sa);
   sa.sin_family = AF_INET;
   sa.sin_addr.s_addr = inet_addr("127.0.0.1");
   sa.sin_port = htons(7654);

   bytes_sent = sendto(sock, buffer, strlen(buffer), 0,(struct sockaddr*)&sa,
sizeof sa);
   if (bytes_sent < 0) {
      printf("Error sending packet: %s\n", strerror(errno));
      exit(EXIT_FAILURE);
   }

   close(sock); /* close the socket */
   return 0;
}
```

20 Network Configuration

Prolin provides the interface for network configuration, including ARP settings, Ping services, DNS configuration, network card configuration, DHCP service, routing settings and PPPoE service etc.

20.1 Return code list

Table 19 Network Configuration return code list

Macro	Value	Description
ERR_NET_SERVER_BAD	-3301	IP server error.
ERR_NET_SERVER_BUSY	-3302	IP server is busy; it can only provide service for at most 5 applications at a time.
ERR_NET_NO_ROUTE	-3305	Haven't configured the router
ERR_NET_FULL	-3306	Connection is full; the application can set up to 20 connections at a time.
ERR_NET_IF	-3307	Network interface link is unavailable (The link has not set up or there is no corresponding device.)
ERR_NET_SESS_BROKEN	-3308	TCP / UDP session connection is

		broken and unavailable.
ERR_NET_PASSWD	-3309	Password is incorrect.
ERR_NET_LOGOUT	-3310	Application logout initiatively.
ERR_NET_INIT	-3311	Initialization failed.
ERR_NET_DHCP_DISCOVER	-3312	Has not found DHCP Server.
ERR_NET_DHCP_OFFER	-3313	DHCP cannot be assigned the IP address.
ERR_NET_DHCP_START	-3314	DHCP has not started.
ERR_NET_DNS	-3315	DNS cannot analyze the corresponding domain.
ERR_NET_SERV_USING	-3316	The port specified by the server is in use.
ERR_NET_NODNServer	-3317	Has not configured the domain name server
ERR_NET_LINKDOWN	-3318	Link is disconnected by the server.
ERR_NET_CONN	-3319	Cannot connect to the specified server.
ERR_NET_TIMEOUT	-3320	Connection timeout
ERR_NET_PPP	-3321	PPP connection error
ERR_NET_SERV	-3322	Has not found the PPPoE server
ERR_NET_AGAIN	-3323	The request resource wasn't found, please try again.
ERR_NET_AUTH	-3324	Has no authority to access to the RADIUS server.
NET_DOING	1	Some related operations are being done.(such as PPP login, DHCP)

20.2 Data Definition

20.2.1 Physical channel list

Table 20 Physical Channel List

Macro	Description
NET_LINK_ETH	Ethernet
NET_LINK_WL	Wireless, including GPRS, CDMA, TDSCDMA
NET_LINK_WIFI	WIFI
NET_LINK_PPPOE	ADSL link
NET_LINK_MODEM	Modem PPP link

NOTE

All of the macro values listed in the above table are positive integers, and they are greater than 0.

For more Details, refer to osal.h.

20.3 Network Configuration interface

20.3.1 OsNetAddArp

Prototype	**int OsNetAddArp(int NetLink, const char *Addr, const char MAC[6]);**	
Function	Adds the IP address to MAC address mapping table, which is static.	
Parameters	NetLink	Physical channel can only be set to Ethernet and WIFI; ▪ NET_LINK_ETH Ethernet; ▪ NET_LINK_WIFI WIFI
	Addr【Input】	IP address. The format is “XXX.XXX.XXX.XXX”, and XXX ranges from 0 to 255. For example: “192.168.0.1”; Cannot be NULL.
	MAC【Input】	the MAC address corresponding to the IP address; Cannot be NULL, the space has 6 bytes.
Return	RET_OK <0	Success Failed, the value is error code.
Instruction		

NOTE

1. Static ARP table is used to resist the attack from ARP Cheat,
2. If there is no static ARP table, the system will dynamically obtain, and it doesn't need to be configured by the application.

20.3.2 OsNetPing

Prototype	**int OsNetPing(const char *Addr, int TimeOutMs);**	
Function	Pings a specific machine to check the status of network connection.	
Parameters	Addr【Input】	The IP address of target device; Format is "XXX.XXX.XXX.XXX", XXX represents 0~255, for example:"192.168.0.3";
	TimeOutMs	Timeout【unit:ms】, the valid range is 3000~3600000.
Return	RET_OK	Success
	ERR_NET_IF	Link is unavailable, means the link has not been set correctly (or has been disconnected).
	ERR_INVALID_PARAM	Invalid parameter
	ERR_TIME_OUT	Timeout
Instruction	Use the default route to do the communication, and searching the route can be done by calling OsNetGetRoute().	

20.3.3 OsNetPingEx

Prototype	**int OsNetPingEx(const char *Addr, int TimeOutMs, int Size);**	
Function	Pings a specific IP address to check the status of the network connection.	
Parameters	Addr 【Input】	IP address of the target device. The format is "XXX.XXX.XXX.XXX", the range of XXX is 0~255, for example "192.168.0.3".
	TimeOutMs【Input】	Timeout 【unit:ms】 the valid range is 3000~3600000.
	Size 【Input】	The size of the data, it can't exceed 1024 bytes.
Return	>0	Success, the time takes to ping
	ERR_NET_IF	Link is unavailable, means the link has not been

		set correctly (or has been disconnected).
	ERR_INVALID_PARAM	Invalid parameter
	ERR_TIME_OUT	Timeout
Usage	Use the default route to do the communication, and searching the route can be done by calling OsNetGetRoute().	

20.3.4 OsNetDns

Prototype	**int OsNetDns(const char *Name, char *Addr, int TimeOutMs);**	
Function	Analyzes the IP address corresponding to the domain name and stores the results in Addr parameter.	
Parameters	Name【Input】	Information of domain name, for example: [www.sina.com.cn]. The maximum length cannot be NULL and cannot exceed255 characters.
	Addr【Output】	It is an output parameter; Use to store the IP address, mapped by the domain name, the format is "XXX.XXX.XXX.XXX", XXX represents 0~255,e.g:"192.168.0.3"; It cannot be NULL; there are at least 16 bytes in the space.
	TimeOutMs	Timeout【unit:ms】, the valid range is 1000~3600000
Return	RET_OK	Success
	ERR_NET_IF	The Link is unavailable, means the link has not been set correctly (or has been disconnected).
	ERR_INVALID_PARAM	Invalid parameter
	ERR_TIME_OUT	Timeout.
	ERR_NET_DNS	The domain server cannot analyze the corresponding domain, or it does not exist.
Instruction	Use the default route to do the communication, and searching the route can be done by calling OsNetGetRoute().	

20.3.5 OsNetSetConfig

Prototype	**int OsNetSetConfig(int NetLink, const char *Addr, const char *Mask, const char *Gateway, const char *DNSServer);**	
Function	Configures the network information.	
Parameters	NetLink	Physical channel can only be set to Ethernet and WIFI; ▪ NET_LINK_ETH Ethernet; ▪ NET_LINK_WIFI WIFI
	Addr【Input】	The address used by POS Format is “XXX.XXX.XXX.XXX”, XXX represents 0~255; e.g: “192.168.0.3”; If it is “ ” or NULL, means do not change the previous configuration;
	Mask【Input】	Mask code used by POS; Format is “XXX.XXX.XXX.XXX”; e.g.: “255.255.255.0”; If it is “ ” or NULL, means do not change the original configuration;
	Gateway【Input】	Address of the default gateway Format is “XXX.XXX.XXX.XXX”, XXX represents 0~255; e.g.: “192.168.0.1”; if it is “ ” or NULL, means do not change the previous configuration;
	DNSServer【Input】	DNS server address Format is “XXX.XXX.XXX.XXX”, XXX represents 0~255; e.g.: “192.168.0.1”; if it is “ ” or NULL, means do not change the previous configuration;
Return	RET_OK	Success
	ERR_NET_IF	The link is unavailable, means the link has not been set correctly (or has been disconnected).
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	1. After calling successfully, the system will stop the DHCP function.	

	2. The function does not check the matching relationship between Addr, Mask and Gateway; it only checks the validity of their formats. 3. Wireless link, PPPoE, and ModemPPP can only be dynamically allocated and cannot be configured by this interface. 4. After setting the configuration successfully, this link will be set to be the default route.

20.3.6 OsNetGetConfig

Prototype	**int OsNetGetConfig(int NetLink, char *Addr, char *Mask, char *Gateway, char *DNSServer);**	
Function	Gets the network configuration information, such as IP, subnet mask, gateway and DNS.	
Parameters	NetLink	Physical channel can only be set to Ethernet and WIFI; ▪ NET_LINK_ETH Ethernet; ▪ NET_LINK_WIFI WIFI(Wireless Local Area Network)
	Addr【Output】	The address used by POS is an Output parameter. There are at least 16 bytes in the space. The format is “XXX.XXX.XXX.XXX”, XXX represents 0~255; e.g.: “192.168.0.3”; It can be NULL.
	Mask【Output】	Mask code used by POS is an Output parameter. There are at least 16 bytes in the space. Format is “XXX.XXX.XXX.XXX”; e.g.: “255.255.255.0”; It can be NULL.
	Gateway【Output】	Address of the default gateway is an Output parameter. There are at least 16 bytes in the space. Format is “XXX.XXX.XXX.XXX”, XXX represents 0~255; e.g.: “192.168.0.1”; It can be NULL.
	DNSServer【Input】	DNS server address is an Output parameter. There are at least 16 bytes in the space. Format is “XXX.XXX.XXX.XXX”, XXX represents 0~255; e.g.: “192.168.0.1”; It can be NULL.

Return	RET_OK ERR_NET_IF	Success The link is unavailable, means the link has not been set correctly.
Instruction		

NOTE

When Addr, Mask, Gateway and DNS Server return the string as " " , that means there is no configuration.

20.3.7 OsNetStartDhcp

Prototype	**int OsNetStartDhcp(int NetLink);**	
Function	Starts the DHCP function to obtain a dynamically assigned address.	
Parameters	NetLink	Physical channel can only be set to Ethernet and WIFI; ▪ NET_LINK_ETH Ethernet; ▪ NET_LINK_WIFI WIFI(Wireless Local Area Network)
Return	RET_OK ERR_NET_IF	Success Has not configured Ethernet or WIFI.
Instruction	1. This interface is only used to start the DHCP function, does not wait for assigning addresses. 2. It can check whether assigning address is completed by calling the OsNetCheckDhcp () or not. 3. After acquiring the address successfully, this link is set to be the default route.	

CAUTION

Before starting the DHCP, it should close all the connections because these connections may not be able to communicate properly in the subsequent activity.

20.3.8 OsNetCheckDhcp

Prototype	**int OsNetCheckDhcp(int NetLink);**	
Function	Check DHCP status.	
Parameters	NetLink	Physical channel can only be set to Ethernet and WIFI; ▪ NET_LINK_ETH Ethernet; ▪ NET_LINK_WIFI WIFI(Wireless Local Area Network)
Return	NET_DOING RET_OK	DHCP is doing the dynamic allocation. Dynamic allocation has been done.

	ERR_NET_DHCP _DISCOVER	DHCP Server has not been found.
	ERR_NET_DHCP _OFFER	DHCP cannot be assigned the IP address.
	ERR_NET_DHCP _START	DHCP does not start.
Instruction		

20.3.9 OsNetStopDhcp

Prototype	**void OsNetStopDhcp(int NetLink);**	
Function	Stops DHCP function.	
Parameters	NetLink	Physical channel can only be set to Ethernet and WIFI; ▪ NET_LINK_ETH Ethernet; ▪ NET_LINK_WIFI WIFI(Wireless Local Area Network)
Return	None	
Instruction	1. After the DHCP function stops, the application needs to re-configure the network using OsNetSetConfig (); 2. After DHCP, the system will regularly update the configuration information, when the update fails, it will cause the network become unusable.	

20.3.10 OsNetSetRoute

Prototype	**int OsNetSetRoute(int NetLink);**	
Function	Set system default route.	
Parameters	NetLink	Physical channel, please refer to Physical channel list
Return	RET_OK	Success, the new route came into effect.
	ERR_INVALID _PARAM	Invalid parameter.
	ERR_NET_IF	This link has not been set up.
Instruction	1. If only one link needs to set up, then it is not necessary to use this interface to do the setup. 2. When there are several links have been set up, it is allowed to use this function to switch the default router. 3. It is allowed to switch only when the default route has been set up, otherwise return ERR_NET_IF. 4. If switch the router in the process of communication, it will cause a communication failure.	

20.3.11 OsNetGetRoute

Prototype	**int OsNetGetRoute(void);**	
Function	Reads the system default route.	
Parameters	None	
Return	>0	Physical channel, please refer to Physical channel list .
	ERR_NET_NO_ROUTE	There is no default route.
Instruction	This function will return ERR_NET_NO_ROUTE in following situations: 1. There is no link has been set up. 2. Any link that has been set up successfully will be configured as the default route. When the last used link is being logged off, it will delete this route. At this time, call OsNetSetRoute to reconfigure .	

20.3.12 OsPppoeLogin

Prototype	**int OsPppoeLogin(const char *Name,** **const char *Password,** **int TimeOutMs);**	
Function	PPPoE link Login.	
Parameters	Name【Input】	User name; Cannot exceed 50 bytes Cannot be NULL, if there is no password, use an null string " ";
	Password【Input】	Password; Cannot exceed 50 bytes Cannot be NULL, if there is no password, use " ";
	TimeOutMs	Timeout,【unit:ms】 The valid range is 0~3600000;
Return	NET_DOING	Logging
	RET_OK	Success
	<0	Failed
Instruction	After the link has been set up successfully, this link will be set to be the default route.	

20.3.13 OsPppoeCheck

Prototype	**int OsPppoeCheck(void);**

Function	Checks the PPPoE link.	
Parameters	None	
Return	NET_DOING	Logging
	RET_OK	The link has been successfully established.
	<0	The link has been disconnected.
Instruction		

20.3.14 OsPppoeLogout

Prototype	**void OsPppoeLogout(void);**	
Function	Disconnects the PPPoE link.	
Parameters	None	
Return	None	
Instruction		

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21 GPRS/CDMA

Prolin provides supports for GPRS and CDMA, for the utility and configuration of these wireless modules. It also provides a series of APIs for application developers to use.

21.1 Return code list

Table 21 GPRS/CDMA return code list

Macro	Value	Description
PPP_LOGINING	1	PPP is logging in.
PPP_LOGOUTING	2	PPP is logging out.
ERR_WL_POWER_ONING	-3501	Module is powered on, please wait.
ERR_WL_POWER_OFF	-3502	Module is powered off.
ERR_WL_NOT_INIT	-3503	Has not called OsWlInit() to initialize and cannot work normally.
ERR_WL_NEEDPIN	-3504	SIM card needs PIN.
ERR_WL_RSPERR	-3505	Module response error.
ERR_WL_NORSP	-3506	Module has no response.

ERR_WL_NEEDPUK	-3507	SIM card needs PUK.
ERR_WL_WRONG_PIN	-3508	PIN of SIM card error.
ERR_WL_NOSIM	-3509	SIM card not inserted
ERR_WL_NOREG	-3510	Cannot register on the GPRS network.
ERR_WL_AUTO_RST	-3511	Module reset automatically.
ERR_WL_BUF	-3512	Module memory error.
ERR_WL_GET_SIGNAL	-3513	Getting the signal, please wait for 3s.
ERR_WL_NOTYPE	-3514	Module cannot be recognized.
ERR_WL_PPP_ONLINE	-3515	PPP is on line, and it cannot be sleeping.
ERR_WL_ERR_BUSY	-3516	Module is busy.
ERR_WL_SLEEP_ONING	-3517	Module is in sleeping.
ERR_WL_SLEEP_FAIL	-3518	Sleeping failed.
ERR_WL_SIM_FAILURE	-3519	SIM card Operation failed.
ERR_WL_NO_SIMSOCKET	-3520	The machine does not have a SIM card slot.
ERR_WL_ONLY_ONE_SIMSOCKET	-3521	The machine only has one SIM card slot.
ERR_WL_SIMSOCKET_CONFIGFILE	-3522	The ro.fac.simsocket in config file is incorrectly set.

21.2 Wireless module interface

21.2.1 OsWlLock

Prototype	**int OsWlLock(void);**	
Function	Opens the wireless module.	
Parameters	None	
Return	RET_OK	Open successfully.

	ERR_DEV_BUSY	Device is already in use.
	ERR_DEV_NOT_EXIST	Device does not exist.
	ERR_BATTERY_ABSENT	Battery is absent
Instruction	1. Before calling OsWlInit(), OsWlPowerSwitch(), OsWlLogin() or OsWlLogout(), this function must be called to open the wireless module first. 2. OsWlUnLock() must be called to close wireless module when there is no operation any more. 3. Noted that S920 and D200 mobile terminals need battery to work.	

21.2.2 OsWlUnLock

Prototype	**void OsWlUnLock(void);**	
Function	Close the wireless module.	
Parameters	None	
Return	None	
Instruction		

21.2.3 OsWlInit()

Prototype	**int OsWlInit(const char *SimPin);**	
Function	Initializes wireless module.	
Parameters	SimPin 【Input】	SIM card PIN, The PIN length can't exceed 50 characters. NULL means it does not need the PIN.
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	Fail to call WlOpen().
	ERR_DEV_NOT_EXIST	Wireless module does not exist.
	ERR_NO_PORT	Not enough physical ports.
	ERR_WL_NEEDPIN	SIM card needs PIN.
	ERR_WL_RSPERR	Response error.
	ERR_WL_NORSP	Module does not respond
	ERR_WL_NEEDPUK	SIM card needs PUK.
	ERR_WL_WRONG_PIN	PIN error.
	ERR_WL_NOSIM	No SIM card.
	ERR_WL_NOTYPE	Module cannot be recognized.
	ERR_WL_NOREG	Registering GPRS network failed.
Instruction	1. Before using this function, make sure to call OsWlLock() successfully.	

	2. This function needs to be called successfully at system startup time before calling OsWlLogin() to establish the link. 3. SIM card will automatically check the password when the password is required. 4. If the module does not power on, the system will automatically supply power for it. 5. When ERR_WL_NOSIM is returned (No SIM card), the application can use some functions that do not require SIM card. 6. After calling OsWlSwitchPower(), application should wait for at least 15 seconds until the module is stable, otherwise, calling OsWlInit() might fail.

21.2.4 OsWlSwitchPower

Prototype	**int OsWlSwitchPower(int OnOff);**	
Function	Powers on /off the wireless module.	
Parameters	OnOff	**0:** Power off **1:** Power on
Return	RET_OK	Success
	ERR_DEV_NOT_EXIST	Wireless module does not exist.
	ERR_DEV_NOT_OPEN	Fail to call OsWlLock().
Instruction	Reserved interface and it is not yet supported.	

NOTE

1. The time it took to power on the different modules is different.
2. Module powers off means directly shutting off the module power supply. .
3. While the power is on, if the wireless module has been detected by the Prolin OS, the system will power on automatically.
4. Please wait for 8 seconds between power off and power on, if the application did not wait enough time to immediately power on, then it will be blocked until it wait long enough to power on .
5. Before power off, it will disconnect ppp automatically.
6. In the state of power off, it should wait for 15 seconds before initializing module and getting signal. The login connection will be performed after 15 seconds, and it results a long time landing.

21.2.5 OsWlSwitchSleep

Prototype	**int OsWlSwitchSleep(int OnOff);**	
Function	Makes the wireless module sleep or wake up.	
Parameters	OnOff	**0:** Wake up **1:** Sleep

		Others: Errors.
Return	RET_OK	Success
	ERR_DEV_NOT_EXIST	Module does not exist.
	ERR_DEV_NOT_OPEN	Fail to call Os WlLock().
	ERR_WL_PPP_ONLINE	PPP is on line.
Instruction	Reserved interface and it is not yet supported.	

NOTE

If it detects the PPP is on line, it will not be in sleep.

For MG323, when there is no inserted SIM card, or has not activated the PIN, or has not registered to the network, it will not be in sleep.

21.2.6 OsWlGetSignal

Prototype	**int OsWlGetSignal(void);**	
Function	Gets the wireless signal strength.	
Parameters	None	
Return	0~5	Represents the signal strength, the higher the number, the stronger the signal, 0 means no signal and 5 represents the strongest signal.
	ERR_DEV_NOT_EXIST	Module does not exist.
	ERR_NO_PORT	Not enough physical uart.
	ERR_WL_POWER_ONING	Module is power on.
Instruction	1. It doesn't need to call OsWLock() when use this function; 2. When the wireless link is not established, this API will get the signal values from the module through AT commands; 3. OsWlGetSignal() can't obtain the current signal strength and returns 'ERR_WL_RSPERR' after a wireless link established by calling OsWlLogin(). In this time, module is in the data exchange mode, can't get the real-time signal.	

21.2.7 OsWlCheck

Prototype	**int OsWlCheck(void);**	
Function	Checks the status of wireless link.	
Parameters	None	
Return	PPP_LOGOUTING	Link disconnecting.
	PPP_LOGINING	Link establishing.
	RET_OK	Link established successful.
	ERR_DEV_NOT_EXIST	Module does not exist.

	ERR_WL_POWER_ONING	Module is powered on.
	ERR_WL_POWER_OFF	Module is powered off.
	ERR_WL_NOT_INIT	Initialization failed.
	ERR_NET_PASSWD	Password is incorrect.
	ERR_NET_LOGOUT	OsWlLogout() disconnect the link.
	ERR_NET_IF	Link has been disconnected.
Instruction		

21.2.8 OsWlLogin

Prototype	**int OsWlLogin(const char *APN, const char *Name, const char *Password, long Auth, int TimeOutMs, int KeepAlive, int ReserParam);**	
Function	Log in on the wireless network and set up a wireless link.	
Parameters	APN 【Input】	APN – Access Point Name for GPRS communication, dialing number for CDMA. Length <= 50 characters; When pointer points to NULL, the application should dial-up first and the protocol stacks directly log in on PPP.

	Name 【Input】	User name;
		Length <= 50 bytes;
		It cannot be NULL, if there is no user name, replace it with an empty string “ ”;

	Password 【Input】	Password;
		Length <= 50 characters;
		It cannot be NULL, if there is no password, replace it with an empty string “ ”;

	Auth	The supported authentication algorithms PPP_ALG_PAP | 0x00000001 | PAP authentication algorithm PPP_ALG_CHAP | 0x0000000 | CHAP

		<table><tr><td></td><td></td><td>authentication algorithm</td></tr><tr><td>PPP_ALG_MSCHAPV1</td><td>0x00000004</td><td>MSCHAPV1 authentication algorithm</td></tr><tr><td>PPP_ALG_MSCHAPV2</td><td>0x00000008</td><td>MSCHAPV2 authentication algorithm</td></tr><tr><td>PPP_ALG_ALL</td><td>0xff</td><td>All algorithms are supported</td></tr></table> At least one type of authentication algorithm has to be chosen; or choose more than one authentication algorithm by using (+) or (|), for example, PPP_ALG_PAP| PPP_ALG_CHAP. If the algorithm is unknown, fill it with PPP_ALG_ALL.
	TimeOutMs	Timeout,【unit:ms】; The valid range is 0~3600000; if it is <0, automatically set it to 0, if more than 360000, automatically set it to 3600000.
	KeepAlive	Interval for link check, unit is ms; The valid range is 10000~3600000; If the link is longer than KeepAlive time but without any messages; the system automatically starts the link check interval;
	ReserParam	Reserved parameter, used for extension.
Return	PPP_LOGINING	In process
	PPP_LOGOUTING	The wireless module is logging out.
	RET_OK	Set up link successfully.
	ERR_DEV_NOT_EXIST	Wireless module does not exist.
	ERR_DEV_NOT_OPEN	Performing OsWlLock() failed
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_WL_POWER_ONING	Module is powered on.
	ERR_WL_POWER_OFF	Module is powered off.
	ERR_WL_NOT_INIT	Initialization failed.
	ERR_NET_PASSWD	Password is incorrect.
	ERR_NET_SERVER_BUSY	Server is busy, communication failure.

	ERR_NET_AUTH Has no authority to access to the RADIUS server.
Instruction	1. Before using this function, make sure to call OsWlLock() successfully. 2. When Timeouts=0,it means return immediately; 3. Calling OsWlCheck() to check the link status; 4. For different modules and different network environments, the login time will be different; if within 60 seconds the login did not complete, it means login failure or the module has an exception error. 5. Unsuccessful login for three consecutive times, it indicates the module has no response, the application must call OsWlSwitchPower() to reset the module. 6. After setting up the link successfully, the link will be set to be the default route and communication can be done through the IP network communication function. 7. When the return vaule is PPP_LOGOUTING, need to call OsWlCheck() function to check whether it has finished logout, and OsWlCheck() returns ERR_NET_LOGOUT means completing logout.

21.2.9 OsWlLoginEx

Prototype	**int OsWlLoginEx(const char *DialNum, const char *APN, const char *Name, const char *Password, long Auth, int TimeOutMs, int KeepAlive, int ReserParam);**	
Function	Log in on the wireless network and set up a wireless link.(it supports modifying the dialing instructions)	
Parameters	DialNum 【Input】	The PPP dialing instruction. Length <= 50 characters; When it is NULL, it adopts the default instruction of system.
	ANP 【Input】	APN – Access Point Name for GPRS communication, dialing number for CDMA. Length <= 50 characters; It cannot be NULL.

	Name 【Input】	User name;
		Length <= 50 bytes;
		It cannot be NULL, if there is no user name, replace it with an empty string “ ”;

	Password 【Input】	Password;
		Length <= 50 characters;
		It cannot be NULL, if there is no password, replace it

		with an empty string " ";
	Auth	The supported authentication algorithms:

PPP_ALG_PAP	0x00000001	PAP authentication algorithm
PPP_ALG_CHAP	0x0000002	CHAP authentication algorithm
PPP_ALG_MSCHAPV1	0x00000004	MSCHAPV1 authentication algorithm
PPP_ALG_MSCHAPV2	0x00000008	MSCHAPV2 authentication algorithm
PPP_ALG_ALL	0xff	All algorithms are supported

		At least one type of authentication algorithm has to be chosen; or choose more than one authentication algorithms by using (+) or (|), for example, PPP_ALG_PAP| PPP_ALG_CHAP. If the algorithm is unknown, fill it with PPP_ALG_ALL.
	TimeOutMs	Timeout, 【unit:ms】; The valid range is 0~3600000; if it is <0, automatically set it to 0, if more than 360000, automatically set it to 3600000.
	KeepAlive	Interval for link check, unit is ms; The valid range is 10000~3600000; If the link is longer than KeepAlive time but without receiving any messages; the system automatically starts the link check interval; (This functionality does not work now, originally it was designed for CDMA to prevent it forming going to sleep.)
	ReserParam	Reserved parameter, used for extension.
Return	PPP_LOGINING	In process
	RET_OK	Set up link successfully.
	ERR_DEV_NOT_EXIST	Wireless module does not exist.
	ERR_DEV_NOT_OPEN	Performing OsWlLock() failed.
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_WL_POWER_ONING	Module is powered on.
	ERR_WL_POWER	Module is powered off.

	_OFF	
	ERR_WL_NOT_INIT	Initialization failed.
	ERR_NET_PASSWD	Password is incorrect.
	ERR_NET_SERVER_BUSY	Server is busy, communication failure.
Instruction	1. This function is similar to OsWlLogin(), when DialNum is NULL, the two functions have the same functionality. 2. Before using this function, make sure to call OsWlLock() successfully. 3. When TimeOutMs=0,it means return immediately; 4. Calling OsWlCheck() to check the link status; 5. For different modules and different network environments, the login time will be different; if the login did not complete in 60 seconds, it means login failure or the module has an exception error. 6. Unsuccessful login for three consecutive times, it indicates the module has no response, the application must call OsWlSwitchPower() to reset the module. 7. After the link has been set up successfully, the link will be set to be the default route and communication can be done through the IP network communication function.	

21.2.10 OsWlLogout

Prototype	**int OsWlLogout(void);**	
Function	Exits the wireless network and disconnects the wireless link.	
Parameters	None	
	PPP_LOGOUTING	The link is being disconnected
	ERR_DEV_NOT_OPEN	Fail to call OsWlLock().
Instruction	1. Before using this function, make sure to call OsWlLock() successfully. 2. After calling this function, OsWlCheck() should be called to check the status of the logout. Only when ERR_NET_LOGOUT is returned does that mean disconnecting the link successfully.	

21.3 Wireless module information settings

21.3.1 OsWlSelSim

Prototype	**int OsWlSelSim(int simno);**	
Function	Selects SIM card.	
Parameters	simno 【Input】	▪ 0: Selecting card slot 1 ▪ 1: Selecting card slot 2 ▪ Others: Parameter error
Return	RET_OK	Success

	ERR_DEV_NOT_EXIST	Module does not exist.
	ERR_DEV_NOT_OPEN	Fail to call OsWlLock().
	ERR_WL_ERR_BUSY	Module is busy.
	Other non-zero value	Refer to the Return code list.
Instruction	1. Before using this function, make sure to call OsWlLock() successfully. 2. After selecting SIM card, the module will be powered on/off, and this function blocks about 15 seconds. Application needs to re-call OsWilInit() to initialize the module. 3. If users select a card slot with bad cards or without any cards, the function will also return successfully. And it can detect the problems while logging in.	

22 WIFI

Prolin WIFI supports two modes: STATION and IBSS(ad-hoc).

1) STATION mode refers to the communication between the wireless modems. IBSS mode is referred to the direct communication between several devices. It can be used in the following situations. Assume that there is an ad-hoc device named ‘A’ in the network, device ‘B’ tries to connect to device ‘A’. If the connection is successful, ‘A’ and ‘B’ can ping successfully with each other; if not, device ‘B’ will create an ad-hoc network by itself;

2) In the network without an ad-hoc device, device ‘B’ will create an ad-hoc network by itself.

3) At present, Prolin WIFI only supports module with keyword *ro.fac.wifi* is “RS9110-N-11-02” or “01”.

22.1 Return Code List

Table 22 Return Code List

Macro	Value	Description
ERR_WIFI_POWER_OFF	-3351	Module is powered off.
ERR_NOT_FOUND_AP	-3352	Has not found AP.
ERR_AUTH_SEC_MODE	-3353	Authentication mode or encryption mode error.

ERR_WIFI_BAD_SIGNAL	-3354	WIFI signal is bad.
RET_CONNECTING	1	Connecting

22.2 Encryption type List

Table 23 Encryption type List

Macro	Value	Description
PARE_CIPHERS_NONE	0x00000000	No encryption
PARE_CIPHERS_WEP64	0x00000001	Means 40 bit key with concatenated 24 bit initialization vector
PARE_CIPHERS_WEP128	0x00000002	Means 104 bit key with 24 bit initialization vector
PARE_CIPHERS_WEPX	0x00000004	Unknown WEP key bits
PARE_CIPHERS_CCMP	0x00000010	AES in Counter mode with CBC-MAC
PARE_CIPHERS_TKIP	0x00000020	Temporal Key Integrity Protocol

22.3 Data Structure

Authentication Modes:

```
enum WIFI_AUTH_MODE{
    AUTH_NONE_OPEN=1,
    AUTH_NONE_WEP,
    AUTH_NONE_WEP_SHARED,   /* The mode will be scanned as
                               AUTH_NONE_WEP */
    AUTH_IEEE8021X,
    AUTH_WPA_PSK,
    AUTH_WPA_EAP,
    AUTH_WPA_WPA2_PSK,
    AUTH_WPA_WPA2_EAP,
    AUTH_WPA2_PSK,
    AUTH_WPA2_EAP
};
```

Extension for WEP64 and WEP128:

```
typedef struct _WepSecKey{
     char Key[4][40];       /* WEP key data */
     int  KeyLen;           /* WEP key data length */
     int  Idx;              /* WEP key index [0..3] of actually used key */
} WEP_SEC_KEY;
```

Extension for WPA/WPA2-PSK:

```
typedef struct _WpaPskKey{
     char Key[64];    /* PSK-Key data */
     int  KeyLen;     /* PSK-Key data length */
} WPA_PSK_KEY;
```

Extension for EAP:

```
typedef struct _WpaEapKey{
     int  EapType;               /* EAP type */
     char Pwd[132];              /* Password */
     char Id[132];               /* Identity */
     char CaCert[132];           /* Path and filename of CA certificate */
     char CliCert[132];          /* Path and filename of client certificate */
     char PriKey[132];           /* File path to client private key file */
     char PriKeyPwd[132];   /* Password for private key file */
} WPA_EAP_KEY;
```

Scan the AP information:

```
typedef struct _WifiApInfo

{

     char Essid[33];        /* AP name */
```

```
    char Bssid[20];       /* MAC address */
    int Channel;          /* Channel */
    int Mode;             /* Connection mode, 0:Station; 1:IBSS */
    int Rssi;             /* Signal value, The value range is [-99,0] */
    int AuthMode;         /* Authentication mode*/
    int SecMode;          /* Encryption mode, NONE,WEP,TKIP,CCMP */
}ST_WifiApInfo;
```

Connect to AP settings:

```
typedef struct _WifiApSet
{
  char Essid[33];       /* AP name, it can support 32 bytes at most, ending
                           with '\0'*/
char Bssid[20];        /* MAC address, ending with '\0', if there is no any APs
                          with the same ESSID, Bssid can be "\0"*/
int Channel;           /* Channel, only valid in IBSS mode, 0:Auto set */
int Mode;              /* Connection mode, 0:Station; 1:IBSS */
int AuthMode;          /* Authentication mode */
int SecMode;           /*Encryption mode, NONE,WEP,TKIP,CCMP*/
union KEY_UNION{         /* Key */
            WEP_SEC_KEY WepKey;  /* For wep */
            WPA_PSK_KEY PskKey;   /* For wpa,wpa2-psk authentication */
            WPA_EAP_KEY EapKey;   /* For wpa,wpa2-eap*/
      } KeyUnion;
}ST_WifiApSet;
```

22.4 OsWifiOpen

Prototype	**int OsWifiOpen(void);**	
Function	Get access to the WIFI module.	
Parameters	None	
Return	RET_OK	Success
	ERR_DEV_NOT_EXIST	Driver loading exception or module error.

	ERR_DEV_BUSY	WIFI is already in use.
	ERR_BATTERY_ ABSENT	Battery does not exist.
Instruction	For D200 and S920 POS models, the battery must be installed in order to operate the Wifi, otherwise ERR_BATTERY_ABSENT will be returned.	

22.5 OsWifiClose

Prototype	**void OsWifiClose (void);**	
Function	Release the WIFI module.	
Parameters	None	
Return	None	
Instruction		

22.6 OsWifiSwitchPower

Prototype	**int OsWifiSwitchPower (int Type);**	
Function	Sets WIFI module into the state of power-on and power-off.	
Parameters	Type	**1:** Set module hardware into the state of power-on **0:** Set module hardware into the state of power-off
Return	RET_OK	Success
	ERR_INVALID_P ARAM	Invalid parameter
	ERR_DEV_NOT_ EXIST	Driver loading exception or module error.
	ERR_DEV_NOT_ OPEN	Fail to access to the WIFI device.
Instruction	The module will automatically power on after the boot, it doesn’t need to call this function. Reserved interface and it is not yet supported.	

22.7 OsWifiScan

Prototype	**int OsWifiScan (ST_WifiApInfo **Aps);**
Function	Search for APs.

Parameters	Aps 【Output】	The searched AP information
Return	>=0	The number of searched APs
	ERR_MEM_FAULT	Memory error
	ERR_INVALID_PARAM	Invalid parameter
	ERR_WIFI_POWER_OFF	WIFI module is powered off.
	ERR_DEV_NOT_OPEN	Fail to access to the WIFI device.

Instruction	/*For example:*/
	int i, num;
	ST_WifiApInfo * Aps;
	num = OsWifiScan (&Aps);
	if(num <= 0)
	return -1;
	for(i=0; i<num; i++)
	printf("[%d] AP name: %s\n", i, Aps[i].Essid);	

22.8 OsWifiConnect

Prototype	**int OsWifiConnect(const ST_WifiApSet *Ap, int TimeOutMs);**	
Function	Connects to AP.	
Parameters	Ap 【Input】	The required connected AP information.
	TimeOutMs 【Input】	The timeout,【unit:ms】 The valid value range is 0~3600000.
Return	RET_OK	Success
	RET_CONNECTING	Connecting
	ERR_NOT_CONNECT	Connection failed.
	ERR_WIFI_BAD_SIGNAL	WIFI signal is bad.
	ERR_NOT_FOUND_AP	The AP can’t be found.
	ERR_ NET_PASSWD	Password error

	ERR_AUTH_SEC_MODE	Authentication mode or encryption mode error
	ERR_WIFI_POWER_OFF	WIFI module is powered off.
	ERR_DEV_NOT_OPEN	Fail to access to the WIFI device.
	ERR_INVALID_PARAM	Invalid parameter
Instruction	1. When the return value is RET_CONNECTING, users can call OsWifiCheck() to check the connection state. 2. After a successful connection, it needs to call OsNetStartDhcp() to get IP, or call OsNetSetConfig() to set the static IP. 3. In IBSS mode, when the connection time exceed 90 seconds, then it will return ERR_NOT_CONNECT, but in the Station mode, it will return a specific error code while the connection fails. 4. RET_CONNECTING will be returned if there is no connection to the network in IBSS mode, at the same time, the network will be created according to the connection parameter, RET-OK will be returned when detected there is a terminal joining the network, if no terminal is detected, and the time exceed 90 seconds, the network will be aborted and returns ERR_NOT_CONNECT; 5. In IBSS mode, to determine whether the connection is successful, the first step is to make sure it returns RET_OK, and then sets the IP, the connection should only be considered successful if the IP can ping the peer IP.	

22.9 OsWifiDisconnect

Prototype	**int OsWifiDisconnect(void);**	
Function	Disconnect AP connection.	
Parameters	None	
Return	RET_OK	Success
	ERR_DEV_NOT_OPEN	Fail to access to the WIFI device.
Instruction		

22.10OsWifiCheck

Prototype	**int OsWifiCheck(char *Essid,** **char *Bssid,**

	int *Rssi);	
Function	Gets the current status of WIFI. If the connection is successful, it can get the ESSID, BSSID and signal strength of AP through the parameters.	
Parameters	Essid 【Output】	It can't be NULL, and the size is 33byte.
	Bssid 【Output】	The size is 20-byte, and it also can be NULL.
	Rssi 【Output】	Signal strength. It can't be NULL, the value range is 【-99, 0】, 0 represents the strongest strength.
Return	RET_OK	Connection successful
	RET_CONNECTING	Connecting
	ERR_NOT_CONNECT	No connection to the network
	ERR_WIFI_BAD_SIGNAL	WIFI signal is bad.
	ERR_NOT_FOUND_AP	Has not fount AP
	ERR_NET_PASSWD	Password error
	ERR_AUTH_SEC_MODE	Authentication mode or encryption mode error
	ERR_INVALID_PARAM	Invalid parameter.
Instruction	1. It does not need to call OsWifiOpen() before calling this interface. 2. It returns ERR_NOT_ CONNECT only in the following cases: a) OsWifiConnect() has not been invoked by any application, b) The connection time exceeds 90 seconds in IBSS mode, c) OsWifiDisconnect() has been invoked by an application and returns RET_OK. 3. If the connection fails in Station mode, it returns values other than ERR_NOT_ CONNECT.	

NOTE

The default status is not connected, that is, without calling OsWifiConnect(), it returns ERR_NOT_CONNECT by calling OsWifiCheck().

22.11OsWifiCmd

Prototype	**int OsWifiCmd (const char *Argv[],**

	int Argc, **char *Result,** **int Len);**	
Function	Send commands to the WPA_Supplicant back-end service, and then obtain the return results.	
Parameters	Argv 【Input】	Commands supported by WPA_Supplicant, it can’t be NULL.
	Argc 【Input】	t Argv two-dimensional array that used to store the number of commands or parameters
	Result 【Output】	Return result of WPA_Supplicant, it can’t be NULL, and the size must be at least 2048 bytes.
	Len 【Input】	Length of Result array
Return	RET_OK	Sent successfully
	ERR_INVALID_PARAM	Invalid parameter.
	ERR_WIFI_POWER_OFF	WIFI module is power off.
	ERR_DEV_NOT_OPEN	Fail to access to the WIFI device.
Instruction	1. Argv represents all the commands and parameters that supported by WPA_Supplicant, such as ‘SCAN’ command. 2. If Argv only has one command, Argc=1. 3. It's worth noting that this function is invoked only when other WIFI APIs cannot meet requirements. 4. Result is the original return value of WPA_Supplicant.	

23 File System

To access the file system, use the standard ANSI.C to operate API. For more details about real-time operation, please refer to<stdio.h>. It is allowed to use the standard POSIX interface to get the access.

24 System Information

In Prolin, the system messages generated by the hardware device are implemented by asynchronous notification. The system provides two kinds of hardware system messages, magnetic cards and IC cards.

- SIGMAG
- SIGICC

The SIGMAG is only valid when the magnetic stripe reader device is open.

The code of registered asynchronous notification function is shown as follows:

EXAMPLE

```
#include <stdio.h>
#include <stdlib.h>
#include <signal.h>
#include <pthread.h>
#include <osal.h>
#include <cutils/log.h>
#define printf(...)       LOGI(__VA_ARGS__)

static sigset_t mask;

void * handler_sigwait(void * arg)
{
    int ret, signo;

    while(1){
        ret = sigwait(&mask, &signo);
        if(ret != 0){
            printf("sigwait err, ret=%d\n", ret);
            break;
        }

        switch(signo){
        case SIGMAG:
            printf("Capture msr signal\n");
            break;

        case SIGICC:
            printf("Capture icc signal\n");
            break;

        default:
            printf("Capture other signal %d\n", signo);
            break;
        }
    }
}

int main()
{
    int ret;
    sigset_t oldmask;
    pthread_t tid;

    ret = OsMsrOpen();
    if (ret < 0)
        exit(-1);

    ret = OsIccOpen(ICC_USER_SLOT);
  if (ret < 0){
    OsMsrClose();
    return -1;
  }
```

```
    sigemptyset(&mask);
    sigaddset(&mask, SIGMAG);
    sigaddset(&mask, SIGICC);

    ret = pthread_sigmask(SIG_SETMASK, &mask, &oldmask);
    if(ret != 0){
        printf("pthread_sigmask error, ret=%d\n", ret);
        exit(-1);
    }

    ret = pthread_create(&tid, NULL, handler_sigwait, 0);
    if(ret != 0){
        printf("pthread_create error, ret=%d\n", ret);
        exit(-1);
    }

    pthread_join(tid, NULL);

    OsMsrClose();
    OsIccClose(ICC_USER_SLOT);
}
```

25 Audio

The speaker volume of Prolin is divided into five levels, ranging from 0 to 4, 0 means mute. In general, the volume setting is unified, and it can set in the TM interface.

25.1 OsPlayWave

Prototype	**int OsPlayWave(const char *Buf, int Len, int Volume, int DurationMs);**	
Function	Play WAV audio files.	
Parameters	Buf 【Input】	The audio data buffer.
	Len 【Input】	Length of the data buffer.
	Volume 【Input】	Volume, the values range from 0 to 4. 0 represents playing in mute.
	DurationMs【Input】	Play duration【Unit:ms】
Return	RET_OK	Success
	ERR_FILE_FORMAT	File format error
	ERR_ACCESS_DENY	Access denied
	ERR_INVALID_PARAM	Invalid parameter
Instruction	1. The Volume value ranges from 0 to 4, when Volume<0, set it as the system volume, that is the value of persist.sys.sound.volume, it can be set	

	in tm; when Volume>4, set is as 4. 2. If the DurationMs is more than the Len play time, it will play on a continuous loop of the file. On the contrary, DurationMs shall prevail. When DurationMs=0, the actual length of the audio data shall prevail. 3. Support WAVE audio file with single track or double track; Support 8-bit sampling , 16 bit sampling. The supported sample frequencies are 8000 Hz,11025 Hz,6000 Hz,22050 Hz,24000 Hz,32000 Hz,44100 Hz and 48000 Hz.

For example, FILENAME is the name of the audio file.

EXAMPLE

```
 int fd, ret = 0;
 char *buff;
 int len;
 struct stat state;

 stat(FILENAME, &state);
 len = state.st_size;

 buff = (char *) malloc(len * sizeof(char));

 fd = open(FILENAME, O_RDONLY);
 if(fd<0)
printf("Open File Fail\n");

 ret = read(fd, buff, len);

 ret = OsPlayWave(buff, len, 3, 0);
 if(ret != RET_OK)
printf("PlayWave Fail\n");

 close(fd);
 free(buff);
```

26 Barcode

26.1 General Definiton

Prolin barcode supports one-dimensional and two-dimensional barcode. One-dimensional code is composed of vertical black and white bars with letters or digits at the bottom of the bars, and the thickness of black and white is different. It used to identify the basic information of products, such as name, price, etc.

Two-dimensional code is a dot matrix form with a rectangular structure. It has some polygon images inside the code, and texture is black and white with different thickness. Two-dimensional code could represent more detailed content in addition to the identification function.

The usage of barcode is as follow: Firstly, OsScanOpen() is called to open the barcode module; Then, OsScanRead() is called and the light beam will be emitted from barcode scanning head, and the barcode scanning head align the code image to get the code information; Lastly, OsScanClose() is called to close the barcode module.

26.2 OsScanOpen

Property	**int OsScanOpen (void);**	
Function	Open the barcode scanning module.	
Parameter	None	
Return	RET_OK	Success

	ERR_DEV_BUSY	Device has been occupied.
	ERR_DEV_NOT_OPEN	Device is not open.
	ERR_DEV_NOT_EXIST	Device does not exist.
Instruction		

26.3 OsScanRead

Property	**int OsScanRead(char *Buf, int Len, int TimeoutMs);**	
Function	Read the barcode.	
Parameter	Buf 【Output】	The buffer is used to store the barcode data. One-dimensional code recommends being more than 512 bytes, and two-dimensional code suggests being 3072 bytes.
	Len 【Input】	Buffer length
	TimeoutMs 【Input】	Timeout of reading barcode, 【unit:ms】 The valid range is 1500~36000, if it is less than 1500, set is to 1500, and if it is greater than 36000, set it to 36000. The margin of error between the actual timeout value and the setting value may be less than 1s, it is recommended to set the timeout value to 3000ms.
Return	>=0	The actual length of the read barcode data.
	ERR_DEV_NOT_OPEN	Device is not open.
	ERR_TIME_OUT	Timeout.
	ERR_INVALID_PARAM	Invalid parameter
Instruction		

26.4 OsScanClose

Property	**void OsScanClose (void);**
Function	Close the scanning device.
Parameter	None
Return	None
Instruction	

27 Power Management

27.1 OsCheckBattery

Prototype	**int OsCheckBattery(void);**	
Function	Checks the battery.	
Parameters	None	
Return	BATTERY_LEVEL_0	It needs immediately charge the battery. At this point, it should not do the transaction, wireless communications and printing. When the battery capacity is low, the system will automatically turn off. 0~5%battery
	BATTERY_LEVEL_1	5%~15% battery
	BATTERY_LEVEL_2	15%~40%battery
	BATTERY_LEVEL_3	40%~70%battery
	BATTERY_LEVEL_4	70%~100%battery
	BATTERY_LEVEL_CHARGE	Battery is being charged.
	BATTERY_LEVEL_COMPLETE	Battery is fully charged, external power supplies the electricity.

	BATTERY_LEVEL_ABSENT	Battery does not exist. It needs external power supplies electricity.
	ERR_SYS_NOT_SUPPORT	System does not support checking the battery. S800/S300 returns this value.
Instruction	1. When using an electric power supply, it can detect whether the battery is full charged or not, but the battery level only can be detected when the batter is in use. 2. It is not recommended to call this function during printing, because the printer requires high current in the printing procedure, otherwise, it will make the interface obtain an inaccurate charge. 3. When RF searching the card, or wireless module attaching to the network, it needs a higher power, then please note that the battery may fluctuate during the above processes. 4. When the battery level is BATTERY_LEVEL_0, wireless module, printer, RF module are probably can not continue to function normally, the battery needs to be charged.	

27.2 OsCheckPowerSupply

Prototype	**int OsCheckPowerSupply (void);**	
Function	Check the power supply type.	
Parameters	None	
Return	POWER_BATTERY	Powered by the battery.
	POWER_ADAPTER	Powered by the adapter.
	POWER_USB	Powered by the USB, such as PC.
Instruction		

27.3 OsSysSleep

Prototype	**int OsSysSleep(void);**	
Function	Make the system enter the sleep mode to save power.	
Parameters	None	
Return	RET_OK	Success
	ERR_SYS_NOT_SUPPORT	System does not support this function.
Instruction	The system will enter sleep mode by calling this function, otherwise, it never sleep. In sleep mode, CPU stops running and the screen is black; Terminal could be	

	awakened up by pressing key, the contents displayed in the screen are the same as before calling this function. System continues running at the breakpoint which was made before sleep. It is not recommended to hibernate during using RF card, if so, after wake up, it must call OsPiccClose() firstly, and then call OsPiccOpen() and other cards operations.

27.4 OsSysSleepEx

Prototype	**int OsSysSleepEx(int Level);**	
Function	Make the POS terminal enter different levels of sleep mode, and reduce the power consumption.	
Parameters	Level 【Input】	Sleep level, value range is [0, 2]. **0:** System runs normally; **1:** Screen save mode. CPU works well, specific performance in turning the LCD, key backlight, touch key, touch screen off. You also can wake up them by plastic button. **2:** System hibernation. CPU stops working, modules can only be awakened by plastic button.
Return	RET_OK	Success
	ERR_INVALID_PARAM	Invalid parameter
	ERR_SYS_NOT_SUPPORT	System hibernation is not Supported.
Instruction	1. When Level=2, it is equivalent to calling the OsSysSleep(); 2. The opened handle will not be closed in any sleep level. 3. The current working state of cards and communication modules will not be changed in level 0 and level 1. In level 2, the modules other than plastic button will be closed. 4. Under normal operation, it will enter the screen save mode if there is no input event within the default interval of one minute. The interval can be set by persist.sys.backlighttime(unit: minute), when persist.sys.backlighttime = 0, it means turn off the screensaver.	

27.5 OsReboot

Prototype	**int OsReboot(void);**
Function	Reboot the machine.

Parameters	None	
Return	ERR_SYS_BAD RET_OK	System error Success
Instruction		

27.6 OsPowerOff

Prototype	**int OsPowerOff (void);**	
Function	Turn off the power.	
Parameters	None	
Return	ERR_SYS_BAD RET_OK	System error Success
Instruction		

Appendix 1 PIN Block Format

Format 0 PIN block

This PIN block is constructed by modulo-2 addition of two 64-bit fields: the plain text PIN field and the account number field. The formats of these fields are described in 1.1.1 and 1.1.2 respectively.

The format 0 PIN block shall be reversibly enciphered when transmitted.

Plain text PIN field

The plain text PIN field shall be formatted as follows.

Bit

1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 64

C	N	P	P	P	P	P	P/F	P/F	P/F	P/F	P/F	P/F	P/F	F	F

where

C = Control field: shall be binary 0000;

N = PIN length: 4-bit binary number with permissible values of 0100(4) to 1100(12);

P = Pin digit: 4-bit field with permissible values of 0000(zero) to 1001(9);

P/F = PIN/Fill digit: designation of these fields is determined by the PIN length field;

F = Fill digit: 4-bit field value 1111(15).

Account number field

The account number field shall be formatted as follows.

Bit

1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 64

0	0	0	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12

where

0 = Pad digit: a 4-big field with the only permissible value of 0000(zero);

A1…A12 = Account number: content is the 12 rightmost digits of the primary account number (PAN) excluding the check digit. A12 is the digit immediately preceding the PAN’s check digit. If the PAN excluding the check digit is less than 12 digits, the digits are right justified and padded to the left with zeros. Permissible values are 0000 (zero) to 1001 (9).

Format 1 PIN block

This PIN block is constructed by concatenation of two fields: the plain text PIN field and the transaction field.

The format 1 PIN block should be used in situations where the PAN is not available.

The format 1 PIN block shall be reversibly enciphered when transmitted.

The format 1 PIN block shall be formatted as follows.

Bit

1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 64

C	N	P	P	P	P	P/T	P/T	P/T	P/T	P/T	P/T	P/T	P/T	T	T

where

C = Control field: shall be binary 0001;

N = PIN length: 4-bit binary number with permissible values 0100(4) to 1100 (12);

P = PIN digit: 4-bitfield with permissible values 0000 (zero) to 1001 (9);

P/T = PIN/Transaction digit: designation of these fields is determined by the PIN length field;

T = Transaction digit: 4-bit binary number with permissible values of 0000 (zero) to 1111 (15).

The transaction field is a binary number formed by [56-(N*4)] bits. This binary shall be unique (except by chance) for every occurrence of the PIN block and can, for example, be derived from a transaction sequence number, time stamp, random number or similar.

The transaction field should not be transmitted and is not required in order to translate the PIN block to another format since the PIN length is known.

Format 2 PIN block

The format 2 PIN block has been specified for local use with IC cards. The format 2 PIN block shall only be used in an offline environment and shall not be used for online PIN verification.

Format 3 PIN block

Format 3 PIN block construction

The format 3 PIN block is the same as format 0 PIN block except for the fill digits.

This PIN block is constructed by modulo-2 addition of two 64-bit fields: the plain text PIN field and the account number field. The formats of these fields are described in 1.4.2 and 1.4.3 respectively.

Plain text PIN field

The plain text PIN field shall be formatted as follows.

Bit

1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 64

C	N	P	P	P	P	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	F	F

where

C = Control field: shall be binary 0011;

N = PIN number: 4-bit binary number with permissible values of 0100 (4) to 1100 (12);

P = PIN digit: 4-bit field with permissible values of 0000 (zero) to 1001 (9);

P/F = PIN/Fill digit: designation of these fields is determined by the PIN length field;

F = Fill digit: 4-bit field, with values from 1010(10) to 1111(15), where the

Fill-digit values are randomly or sequentially selected from this set of six possible values, such that it is highly unlikely that the identical configuration of fill digits will be used more than once with the same account number field by the same PIN encipherment device.

Account number field

The account number field shall be formatted as follows.

Bit

1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 64

0	0	0	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12

For more details related to PIN Block format please refer to ISO 9564-1:2002(E).

Appendix 2 EPS PINBLOCK Format

String format: “1234”+ISN [6 byte] +PIN [Byte bit];

If the PIN is less than 6 bytes, add ‘0’ before PIN;

The data string will be converted to BCD code, Using TPK to process DES/TDES encryption for BCD code.

Appendix 3 Registry Table

The names begin with "ro.fac." can be read-only, for "persist.sys.", it can be both write and read.

System configuration name	Note
ro.fac.ubootver	Uboot version information
ro.fac.hwver	Hardware version number. Main board- Interface board.
ro.fac.mach	Product type name.
ro.fac.boardid	The information about the product ‘boardid’ includes the product model type and hardware version number ect.
ro.fac.conf.ver	Version information of configuration files.
ro.fac.pn	PN number
ro.fac.sn	SN number
ro.fac.prolin_debug_level	The current system Prolin debug_level information. Values of release version system and debug version system are 0 and 1 respectively.
ro.fac.eth	Whether there is network cable.(0- does not exist, 1- exist)
ro.fac.usb.host	Whether there is the main device interface.(0- does not exist, 1- exist)
ro.fac.usb.device	Whether there is an USB device interface.(0- does not exist, 1- exist)
ro.fac.usb.otg	Whether there is an USB OTG interface.(0- does not exist, 1- exist)
ro.fac.leddt	Whether there is LED digital tube.(0- does not exist, 1- exist)
ro.fac.keybroad	Key types.(0- have no keys, 1- indicates the presence of physical buttons, 2- indicates the presence of a touch-screen buttons)
ro.fac.buzzer	Whether there is a Buzzer module.(0- does not exist, 1- exist)
ro.fac.simsocket	The number of SIM card slot.
ro.fac.battery	Whether there is a battery.(0- does not exist, 1- exist)
ro.fac.wifi	Name of WIFI module.(If none, it means does not exist by default)
ro.fac.bt	Name of Bluetooth module. (If none, it means does not exist by default)
ro.fac.radio	Wireless module information, and the parameter information is optional. It needs to isolate when there are multiple wireless modules. (If none, it means does not exist by default)
ro.fac.modem	Name of Modem module. (If none, it means does not exist by default)
ro.fac.printer	Name of Printer module. (If none, it means does not exist by default)

ro.fac.pcd	Name of PCD module. (If none, it means does not exist by default)
ro.fac.sci	Name of ICC Reader. (If none, it means does not exist by default)
ro.fac.msr	Name of MSR Reader. (If none, it means does not exist by default)
ro.fac.videocard	Name of video card module. (If none, it means does not exist by default)
ro.fac.audiocard	Name of audio card module. (If none, it means does not exist by default)
ro.fac.touchscreen	Name of Touch-screen module. (If none, it means does not exist by default)
ro.fac.sdhc	The specification, capacity range and speed level supported by SD card. (If none, it means does not exist by default)
ro.fac.scanner	Name of Scanner module. (If none, it means does not exist by default)
ro.fac.pcd.param1	PCD antenna parameter 1. (If none, it needn't to fill in.)
ro.fac.pcd.param2	PCD antenna parameter 2. (If none, it needn't to fill in.)
ro.fac.pcd.param3	PCD antenna parameter 3. (If none, it needn't to fill in.)
ro.fac.lcd.rotate	The LCD clockwise rotation degrees. ("0","90","180","270")
persist.sys.eth0.enable	Supported Ethernet or not. ("true" or " "- support, "false"- does not support)
persist.sys.eth0.dhcp	DHCP is open or not. ("true" - opened, "false" or " "- closed)
persist.sys.eth0.ip	Ethernet ip address
persist.sys.eth0.mask	Ethernet subnet mask
persist.sys.eth0.gateway	Ethernet gateway
persist.sys.dns1	System Preferred DNS
persist.sys.dns2	System alternative DNS
persist.sys.eth0.speed	network port speed.("eth_auto" represents automatic configuration, "eth_10mhd" represents 10M half-duplex, "eth_10mfd" represents 10M full-duplex, "eth_100mhd" represents 100M half-duplex, "eth_100mfd" represents 100M full-duplex)
persist.sys.prolin	Prolin system version information
persist.sys.language	System language
persist.sys.backlighttime	LCD backlight waits ‘backlighttime’ minutes, then it will automatically turn off (value ranges from 0 to 32767, 0 means LCD backlight is turned on)
persist.sys.key.backlight	Whether the button backlight is open or not (0 means close, 1 means open)
persist.sys.lcd.brightness	LCD brightness (value ranges from 1 to 10, the higher, the brighter)

persist.sys.sound.enable	Whether the beep is open or not(false means close, true means open)
persist.sys.sound.volume	Beep sound volume (value ranges from 1 to 99)

Appendix 4 Validity of models and contents

According to the differences of the hardware design, some OSAL interfaces cannot take into effect on a certain model. For more, refer to the table below.

NOTE

Whether there is Wireless module, Modem module or Ethernet module depends on the model configuration.(Refer to the POS PN number)

Chapters	S300	S800	S920	D200
Thread	√	√	√	√
System Function	√	√	√	√
Encryption and Decryption	√	√	√	√
PED	√	√	√	√
LCD	240*320, rotate 90° in clockwise direction	320*240, rotate 90 ° in clockwise direction	240*320, rotate 90 ° in clockwise direction	240*320, no rotation
Keyboard	√	√	√	√
Touch Screen	√	NA	√	NA
Signature Pad	√	NA	√	NA
Printer	NA	√	√	NA
Font Library	√	√	√	√
Code	√	√	√	√
MSR	√	√	√	√
ICC Reader	√	√	√	√
RF Reader	√	√	√	√

Communication Port	PORT_COM1 PORT_USBDEV PORT_USBHOST	PORT_COM1 PORT_COM2 PORT_PINPAD PORT_USBDEV PORT_USBHOST	PORT_USBDEV PORT_USBHOST	PORT_COM1 PORT_USBDEV
MODEM	N/A	√	N/A	N/A
Network Communication	√	√	N/A	N/A
Network Configuration	√	√	N/A	N/A
GPRS/CDMA	N/A	√	√	N/A
WIFI	N/A	N/A	√	√
File System	√	√	√	√
System Information	√	√	√	√
Audio	√	√	√	N/A
Power Management	N/A	N/A	√	√
Barcode	N/A	N/A	N/A	N/A
Bluetooth	N/A	N/A	√	√

NOTE

Above table is based on the fully configured models.

Prolin API Programming Guide

PAX Technology Limited www.pax.com.hk

Hong Kong
Room 2416, 24/F, Sun Hung Kai Centre, 30 Harbour Road,
Wanchai, Hong Kong
Tel: +852-25888800
Fax: +852-28023300

Shenzhen
4/F, No.3 Building, Software Park, Second Central Science-Tech Road,
High-Tech Industrial Park, Shenzhen, Guangdong 518057, P.R. China
Tel: +86-755-86169630
Fax: +86-755-86169634