ABT-SAPI User Manual

Version 1.2.0

INDEX

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1 Introduction

The ABT-SAPI libraries was developed to provide a complete support and control of the ABtrack terminals' hardware. Each library provide a high level atomic functions to perform all the basic operation on the ABtrack terminals.

This API version is developed for all terminals of the ABtrack family. If a function for a particular hardware (for example gyroscope) is called on a terminal that hasn't it, a particular error value will be returned.

Similary, if a function uses a generic data structure that contains fields for hardware that is not on the terminal (for example analog input 4 on ABT40 or ABT20), a default value will be stored in that field by the read operations.

1.1 Naming and Syntax

All the API functions will have a name with a prefix that describes the library where are defined. That prefixes so describes a group of utilities included in a single library:

PREFIX	DESCRIPTION
abGPS	GPS module
abDIO	Digital I/O's
abPWR	Power management
abSYS	System functions (sleep, watchdog, RTC)
abMSR	Analog measurements (analog inputs, accelerometer, gyroscope, odometer based speed and distance)
abGSM	Phone control functions, calls, SMS and PPP connection
abCAN	Can bus

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1.2 Use of the libraries

Each library will be released with two files, a header and a library. An additional header will be included, where are defined some basic types.

Compile a program with the API:

In the source code of the program must be inluded all the headers of the libraries that will be used. If necessary, the *baseTypes.h* header can be included. When compile the program, it is necessary to pass to the compiler the path of both headers and libraries folder.

Execute a program with API:

To execute a program compiled with the API, all the libraries must be installed in the */usr/lib* folder of the terminal.

NOTE: For a correct behavior of GSM connection function, copy the scripts *ip-up* and *ip-down* in the */etc/ppp* folder of the terminal

1.3 Structure of the libraries

All the libraries have two functions for initialization and deinitialization of the libraries. In some libraries these function are included in the PowerOn/PowerOff functions, otherwise the library has

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Initialize/Unitialize functions. For a correct behavior of the libraries, that functions must be called first.

Other functions are relative to the single group of utilites, so each of them will be described in this manual.

1.5 Base Data types and Data structures

In the baseTypes.h header are defined all the base types and structures used by the libraries. These are described in the next tables:

Data structures

dateTime_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
day	int	Day of month (1-31)
month	int	Month (1-12)
Year	int	Year (in full format, ex. 2012)
Hour	int	Hour (0-24)
Minutes	int	Minutes (0-59)
Seconds	int	Seconds (0-59)

Constants

bool_t		
NAME	**VALUE**	**DESCRIPTION**
B_FALSE	0	False
B_TRUE	1	True

standbyType_t		
NAME	**VALUE**	**DESCRIPTION**

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S_FULLSTANDBY	0	If device permits, a low consumoption state
S_SOFTSTANDBY	1	Suspension of internal routines

abError_t		
NAME	**VALUE**	**DESCRIPTION**
ABERR_OK	0	Ok, no errors occured
ABERR_IOERROR	-1	Error in read/write operations
ABERR_OPERROR	-2	Generic error in the opration
ABERR_VALERROR	-3	Wrong value passed as parameter
ABERR_SEMERROR	-4	Error in syncronization system
ABERR_PRODCHECKERROR	-5	Cannot check hardware type
ABERR_NOHARDWARE	-6	No hardware on the terminal
ABERR_INITERROR	-7	Library not initialized
ABERR_ATERROR	-8	Error while comunicating with the phone module

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2 API Description

2.1 abGPS

The abGPS library includes all functions to get the GPS localization and navigation informations provided by the on board GPS module.

2.1.1 Constants

fixState_t		
NAME	**VALUE**	**DESCRIPTION**
GPSFIX_NOFIX	0	No fix
GPSFIX_2DFIX	1	Fix without altitude information
GPSFIX_3DFIX	2	Full 3D fix
GPSFIX_MODULEERROR	3	GPS module in an error state

2.1.2 Data structures

gpsData_t			
FIELD NAME	**DATA TYPE**	**UNIT**	**DESCRIPTION**
timeDate	timeDate_t	/	Date and time in GMT
Position			
latitude	Float	decimal degrees	Latitude
longitude	Float	decimal degrees	Longitude
altitude	Float	M	Altitude
Navigation			
speed	float	m/s	GPS based speed
direction	float	degrees	Direction
dataQuality			
fixState	fixState_t	/	Fix states

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numSatellites	int	/	Number of used satellites
dop	float	/	Dilution of precision
antennaAttached	bool_t	/	Antenna attached

2.1.3 Functions

abGPS	
Funzione	**Descrizione**
abGPS_PowerOn	Power on the module and initialize the library
abGPS_PowerOff	Power off the module and uninitialize the library
abGPS_Standby	Puts the module in a sleep state
abGPS_Restore	Resume the module from a sleep state
abGPS_Read	Reads GPS data

2.1.3.1 abGPS_PowerOn

DESCRIPTION

Power on the GPS module, initialize the library and starts the data collector

DEFINITION

abError_t abGPS_PowerOn( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_PRODCHECKERROR:** Cannot check hardware type
- **ABERR_NOHARDWARE:** terminal hasn't GPS module hardware installed
- **ABERR_IOERROR:** Cannot power on the module
- **ABERR_OPERROR:** Cannot initialize library

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2.1.3.2 abGPS_PowerOff

DESCRIPTION

Stops the data collector, deinitialize the library and power off the GPS module

DEFINITION

abError_t abGPS_PowerOff( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GPS module hardware installed
- **ABERR_IOERROR:** Cannot power off the module
- **ABERR_OPERROR:** Cannot deinitialize library

2.1.3.3 abGPS_Standby

DESCRIPTION

Stops the data collector and suspend the GPS module

DEFINITION

abError_t abGPS_Standby(standbyType_t standby)

PARAMETERS

- **Stanby:** if S_FULLSTANBY, stops the routines and put the receiver in a low consumption state, otherwise just stops the internal routines

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GPS module hardware installed
- **ABERR_IOERROR:** Cannot suspend the module
- **ABERR_OPERROR:** Cannot stop data collector, or module is already suspended

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2.1.3.4 abGPS_Restore

DESCRIPTION

Resume the GPS module from standby and restart the data collector

DEFINITION

abError_t abGPS_Restore(standbyType_t standby)

PARAMETERS

- **Standby:** if S_FULLSTANDBY puts the receiver in a full power mode and restarts routines, otherwise just restart them

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GPS module hardware installed
- **ABERR_IOERROR:** Cannot restore the module
- **ABERR_OPERROR:** Cannot rsume data collector, or module isn't in standby

2.1.3.5 abGPS_Read

DESCRIPTION

Returns the data provided by the GPS module

DEFINITION

abError_t abGPS_Read(gpsData_t* gpsData)

PARAMETERS

- **gpsData:** pointer to a gpsData_t structure where the values will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GPS module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_SEMERROR:** Error in synchronization system

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2.1.4 Examples

2.1.4.1 GPS data monitor

This example reads and print on screen the GPS data for 5 minutes:

```
#include <stdio.h>
#include <string.h>
#include "abGPS.h"
#include "baseTypes.h"

int main(){

    int i;
    gpsData_t gpsData;
    abError_t err;

    // Power on the GPS module and initializes the library

    abGPS_PowerOn();

    i = 0;
    while(i<300){

        // Reads the data

        err = abGPS_Read(&gpsData);
        if (err == ABERR_OK){

            switch(gpsData.dataQuality.fixState){
                case GPSFIX_NOFIX: strcpy(fixx, "NO FIX"); break;
                case GPSFIX_2D: strcpy(fixx, "2D FIX"); break;
                case GPSFIX_3D: strcpy(fixx, "3D FIX"); break;
                default: strcpy(fixx, "UNKNOWN FIX"); break;
            }

            d_printf("Position %f lat, %f lon, %f m alt\n", gpsData.position.latitude,
               gpsData.position.longitude, gpsData.position.altitude);
            d_printf("Date: %d/%d/%d, Time: %d:%d:%d\n", gpsData.timeDate.day,
               gpsData.timeDate.month, gpsData.timeDate.year, gpsData.timeDate.hour,
               gpsData.timeDate.minutes, gpsData.timeDate.seconds);
            d_printf("Navigation: %f degrees at %f m/s\n", gpsData.navigation.direction,
               gpsData.navigation.speed);
            d_printf("Precision %s with %d satellites in view, %f DOP (Antenna:%d)\n",
               fixx, gpsData.dataQuality.numSatellites, gpsData.dataQuality.dop,
               gpsData.dataQuality.antennaAttached);
        }


        sleep(1);
        i++;

    }

    // Stops the libraty and turn off the GPS module
    iGPS_PowerOff();

    return 0;
}
```


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2.2 abGSM

Library abGSM can be used to control the on board phones. For each phone module, is possible to check status, network status, perform data/voice calls, send and receive SMS, and control eventually PPP connections.

2.2.1 Constants

gsmDevice_t		
NAME	**VALUE**	**DESCRIPTION**
G_GSM1	1	GSM 1 module
G_GSM2	2	GSM 2 module *

**on ABT20,ABT21 and ABT40 terminals the second module isn't available*

registrationStates_t		
NAME	**VALUE**	**DESCRIPTION**
REG_NOTREGISTERED	0	Not registered to network
REG_REGISTERED	1	Registered to network
REG_SEARCHING	2	Currently searching for available networks
REG_REGISTEREDROAMING	3	Registered but in roaming mode

callType_t		
NAME	**VALUE**	**DESCRIPTION**
CALL_VOICE	0	Voice call
CALL_DATA	1	Data call

callDirection_t		
NAME	**VALUE**	**DESCRIPTION**
CALL_INCOMING	0	Incoming call
CALL_OUTGOING	1	Outgoing call

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callStatus_t		
NAME	**VALUE**	**DESCRIPTION**
CALL_NOCALL	0	No call in progress
CALL_RINGING	1	Phone ringing
CALL_ACTIVE	2	Call in progress
CALL_STANDBY	3	Call in standby

gsmNetworkSelection_t		
NAME	**VALUE**	**DESCRIPTION**
NET_AUTOMATIC	0	Automatic network selection
NET_MANUAL	1	Manual network selection

gsmAudioChannel_t		
NAME	**VALUE**	**DESCRIPTION**
AUDIO_NOTAMPLIFIED	0	Not amplified audio * **
AUDIO_HANDSFREE	1	AMplified hands-free audio channel **

* *On ABT50 not amplified audio isn't available, and channel selection is forced to Handsfree*
** *On GSM module 2 audio channels aren't available*

OTHER CONSTANTS		
NAME	**VALUE**	**DESCRIPTION**
MAX_GSM_NUMBER_SIZE	20	Maximum size of a phone number
MAX_APN_SETTINGS_SIZE	50	Maximum size of APN parameters
MAX_SMS_SIZE	200	Maximum size for SMS storage

2.2.2 Data structures

gsmStatus_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
registrationState	registrationStates_t	Registration state
currentOperator	char[50]	Name of the current operator
pppUp	bool_t	PPP status (TRUE=up, FALSE=down)
signalQuality	int	Signal quality from 0 to 31
newSms	bool_t	New SMS received
call		
callType	callType_t	Call type
callStatus	callStatus_t	Call status
callDirection	callDirection_t	Call direction

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number	char[MAX_GSM_NUMBER_SIZE]	Number of the call interlocutor

gsmSettings_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
networkSelection	gsmNetworkSelection_t	Network selection
networkOperatorsCode	char[10]	International operator code for manual selection
smsServiceCenter	char[MAX_GSM_NUMBER_SIZE]	SMS service center number
audio		
channel	gsmAudioChannel_t	Audio channel
speakerVolume	int	Speaker volume (from 0 to 4)
microphoneVolume	int	Microphone volume (from 0 to 7)
ppp		
apn	char[MAX_APN_SETTINGS_SIZE]	APN name
apnUsername	char[MAX_APN_SETTINGS_SIZE]	APN username *
apnPassword	char[MAX_APN_SETTINGS_SIZE]	APN password *

** If the APN doesen't require authentication, leave these fields as empty string*

gsmSms_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
number	char[MAX_GSM_NUMBER_SIZE]	Number of the sender
payload	char[MAX_SMS_SIZE]	Content of the message
timeDate	timeDate_t	Date and time when SMS was received

2.2.3 Functions

abGSM	
Funzione	**Descrizione**
abGSM_PowerOn	Power on the module and initialize the library
abGSM_PowerOff	Power off the module and uninitialize the library
abGSM_ReadStatus	Reads the status of the phone
abGSM_Settings	Sets the desired parameters to the phone
abGSM_MakeCall	Make a data/voice call
abGSM_CloseCall	Close a call
abGSM_AnswerCall	Answer to a call
abGSM_DataCallSend	Sends data trough a data call connection
abGSM_DataCallReceive	Receive data from a data call connection

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abGSM_SendSMS	Sends a SMS
abGSM_ReadSMS	Reads a SMS
abGSM_ConnectPPP	Establish a PPP connection
abGSM_DisconnectPPP	Put down a PPP connection
abGSM_Standby	Stops internal routines
abGSM_Restore	Restart internal routines

2.2.3.1 abGSM_PowerOn

DESCRIPTION

Power on the GSM module and initialize it

DEFINITION

abError_t abGSM_PowerOn(gsmDevice_t device, char* pinCode)

PARAMETERS

- **device:** phone on which apply the action
- **pinCode:** Pin code of the SIM card

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_PRODCHECKERROR:** Cannot check hardware type
- **ABERR_NOHARDWARE:** terminal hasn't GSM module installed
- **ABERR_IOERROR:** Cannot power on the module
- **ABERR_OPERROR:** Cannot initialize library
- **ABERR_VALERROR:** Pin is required but no pin was passed as parameter
- **ABERR_SEMERROR:** Error in synchronization system
- **ABERR_ATERROR:** Cannot perform all operations on the phone

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2.2.3.2 abGSM_PowerOff

DESCRIPTION

Deinitialize the library and power off the GSM module

DEFINITION

abError_t abGSM_PowerOff(gsmDevice_t device)

PARAMETERS

- **device:** phone on which apply the action

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_OPERROR:** Cannot deinitialize library
- **ABERR_IOERROR:** Cannot power off the module

2.2.3.3 abGSM_ReadStatus

DESCRIPTION

Reads the status of the phone

DEFINITION

abError_t abGSm_ReadStatus(gsmDevice_t device, gsmStatus_t* status)

PARAMETERS

- **device:** phone on which apply the action
- **status:** pointer to a data structure for store the phone status informations

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed

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- **ABERR_IOERROR:** Cannot get the informations
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_ATERROR:** An error occurred in the phone operations

2.2.3.4 abGSM_Settings

DESCRIPTION

Set the parameters for a correct behavior of the phone

DEFINITION

abError_t abGSM_Settings(gsmDevice_t device, gsmSettings_t settings)

PARAMETERS

- **device:** phone on which apply the action
- **settings:** settings for the phone. If there is some settings that don't want use, leave the fields empty

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_IOERROR:** Cannot write settings
- **ABERR_ATERROR:** An error occurred in the phone operations
- **ABERR_INITERROR:** Library not initialized

2.2.3.5 abGSM_MakeCall

DESCRIPTION

Make a data or a voice call

DEFINITION

abError_t abGSM_MakeCall(gsmDevie_t device, callType_t callType,
char number[MAX_GSM_NUMBER_SIZE])

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PARAMETERS

- **device:** phone on which apply the action
- **callType:** defines if is a voice call or a data call
- **number:** number to call

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_ATERROR:** Cannot call

2.2.3.6 abGSM_CloseCall

DESCRIPTION

Close a data or a voice call

DEFINITION

abError_t abGSM_CloseCall(gsmDevie_t device)

PARAMETERS

- **device:** phone on which apply the action

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERROR_IOERROR:** No call to close
- **ABERR_OPERROR:** Cannot check calls
- **ABERR_ATERROR:** Cannot call

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2.2.3.7 abGSM_AnswerCall

DESCRIPTION

Answer to a data or a voice call. The library will check automatically what type of call is. If it is a data call, after answer will wait up to 60 seconds that the data call connection is correctly established

DEFINITION

abError_t abGSM_AnswerCall(gsmDevie_t device, int numRings)

PARAMETERS

- **device:** phone on which apply the action
- **numRings:** number of rings to wait befor answering

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERROR_IOERROR:** No call to answer
- **ABERR_OPERROR:** Cannot establish a connection
- **ABERR_ATERROR:** Cannot answer

2.2.3.8 abGSM_DataCallSend

DESCRIPTION

Sends data trough a data call connection

DEFINITION

abError_t abGSM_DataCallSend(gsmDevie_t device, char* payload, int plLength)

PARAMETERS

- **device:** phone on which apply the action
- **payload:** a buffer of bytes to send
- **plLength:** number of bytes to send

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RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERROR_VALERROR:** Empty payload
- **ABERR_IOERROR:** Cannot send data

2.2.3.9 abGSM_DataCallReceive

DESCRIPTION

Reads data from a data call connection

DEFINITION

abError_t abGSM_DataCallReceive(gsmDevie_t device, char* payload, int* plLength)

PARAMETERS

- **device:** phone on which apply the action
- **payload:** a buffer for store the answer
- **plLength:** pointer to a variable where the number of read bytes will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_IOERROR:** Cannot read data

2.2.3.10 abGSM_SendSMS

DESCRIPTION

Sends a SMS

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DEFINITION

abError_t abGSM_SendSMS(gsmDevie_t device, gsmSms_t sms)

PARAMETERS

- **device:** phone on which apply the action
- **sms:** sms to send (fill payload and number in the structure)

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_IOERROR:** Cannot write sms to the module
- **ABERR_ATERROR:** Cannot send

2.2.3.11 abGSM_ReadSMS

DESCRIPTION

Reads a SMS. When read with success, it isstored in the structure ad will be deleted from the phone

DEFINITION

abError_t abGSM_ReadSMS(gsmDevie_t device, gsmSms_t* sms)

PARAMETERS

- **device:** phone on which apply the action
- **sms:** pointer to a structure for store the sms

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_OPERROR:** Cannot read or no SMS in memory
- **ABERR_ATERROR**: cannot check if there are SMS to read

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2.2.3.12 abGSM_ConnectPPP

DESCRIPTION

Establish a PPP connection

DEFINITION

abError_t abGSM_ConnectPPP(gsmDevie_t device)

PARAMETERS

- **device:** phone on which apply the action

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized
- **ABERR_OPERROR:** Cannot connect

2.2.3.13 abGSM_DisconnectPPP

DESCRIPTION

Turn down a PPP connection

DEFINITION

abError_t abGSM_DisconnectPPP(gsmDevie_t device)

PARAMETERS

- **device:** phone on which apply the action

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_INITERROR:** Library isn't initialized

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2.2.3.14 abGSM_Standby

DESCRIPTION

Stops internal routines

DEFINITION

abError_t abGSM_Standby( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed
- **ABERR_IOERROR:** Caanot stop internal routines

2.2.3.15 abGSM_Restore

DESCRIPTION

Restart internal routines

DEFINITION

abError_t abGSM_Restore( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_NOHARDWARE:** terminal hasn't GSM module hardware installed

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2.2.4 Examples

2.2.4.1 SMS Reader

In this example the program will check for 5 minutes if there is a new SMS; if yes, it will be printed. After that, if the message contains “HELLO”, the program will snd back a message containing “WORLD”.

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

#include "abGSM.h"
#include “baseTypes.h”



int main(){

    int i;
    abError_t err;
    gsmSms_t sms;


    abGSM_PowerOn(G_GSM1, NULL);



    while(i<300){
        sleep(1);
        i++;

        err = abGSM_ReadSMS(G_GSM1, &sms);
        if (err == ABERR_OK){
            printf("Read message from %s in date %d/%d/%d,%d:%d:%d:\n%s\n", sms.number,
                    sms.timeDate.day, sms.timeDate.month, sms.timeDate.year,
                    sms.timeDate.hour, sms.timeDate.minutes, sms.timeDate.seconds,
                    sms.payload);

            if (strstr(sms.payload, "HELLO") != NULL){
                strcpy(sms.payload, "WORLD");
                err = abGSM_SendSMS(G_GSM1, sms);
            }
        }

    }

    abGSM_PowerOff(G_GSM1);
    return 0;
}
```


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2.2.4.2 GSM status managed PPP Connection

This example checks the status of the GSM signal for manage the PPP connection. To permits PPP connection, phone must not be in roaming and the signal must be higher than 5/30, otherwise the connection will be closed

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

#include "abGSM.h"
#include “baseTypes.h”



int main(){

    gsmStatus_t status;
    gsmSms_t sms;
    gsmSettings_t settings;


    abGSM_PowerOn(G_GSM1, NULL);

    strcpy(settings.smsServiceCenter, "");
    settings.networkSelection = NET_MANUAL;
    strcpy(settings.networkOperatorsCode, "22210");
    settings.audio.channel = AUDIO_HANDSFREE;
    settings.audio.speakerVolume = 0;
    settings.audio.microphoneVolume = 0;
    strcpy(settings.ppp.apn, "web.omnitel.it");
    strcpy(settings.ppp.apnUsername, "");
    strcpy(settings.ppp.apnPassword, "");
    abGSM_Settings(G_GSM1, settings);


    while(1){
        abGSM_ReadStatus(G_GSM1, &status);
        if (status.pppUp == B_FALSE){
            if ((status.registrationState == REG_REGISTERED) &&
                                                (status.signalQuality > 4)){
                abGSM_ConnectPPP(G_GSM1);
            }
        }else{
            if ((status.registrationState != REG_REGISTERED) ||
                                                (status.signalQuality < 5)){
                abGSM_DisconnectPPP(G_GSM1);
            }
        }
        sleep(1);
    }

    abGSM_PowerOff();

    return 0;
}
```


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2.3 abCAN

The abCAN library includes all functions to retrieve the informations provided by the CAN bus of the vehicle.

2.3.1 Constants

canProtocol_t		
NAME	**VALUE**	**DESCRIPTION**
PR_NONE	0	Don't use the CAN parser
PR_FMS	1	Parse with FMS protocol
PR_J1939	2	Parse with J1939 protocol

canDevice_t		
NAME	**VALUE**	**DESCRIPTION**
C_CAN0	0	Can 0 interface
C_CAN1	1	Can 1 interface *

** CAN1 interface is available only on ABT50 terminal*

direction_t		
NAME	**VALUE**	**DESCRIPTION**
D_FORWARD	0	Moving forward
D_BACKWARD	1	Moving backward

pedalState_t		
NAME	**VALUE**	**DESCRIPTION**
P_RELEASED	0	Pedal released
P_PRESSED	1	Pedal pressed

driverState_t		
NAME	**VALUE**	**DESCRIPTION**
S_REST	0	Driver rest
S_DRIVERAVAILABLE	1	Driver available
S_WORK	2	Loading or working

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S_DRIVE	3	Driving
S_ERROR	4	Error
S_UNAVAILABLE	5	Not available

2.3.2 Data structures

canData_t					
FIELD NAME	**DATA TYPE**	**UNIT**	**DESCRIPTION**	**FMS**	**J1939**
fuel					
fuelRate	float	L/h	Fuel rate	√	√
fuelEconomy	float	km/L	Fuel economy at current speed	√	√
averageFuelEconomy	float	km/L	Average fuel economy	X	√
fuelLevel	float	L	Current fuel level	√	√
totalFuelUsed	float	L	Total fuel used	√	√
tripFuelUsed	float	L	Fuel used in current journey	X	√
fuelDeliveryPressure	float	kPa	Gage pressure of fuel	X	√
engine					
engineSpeed	int	rpm	Engine speed	√	√
engineThrottlePosition	float	%	Position of the throttle valve		√
engineHours	float	H	Total engine hours	√	√
engineLoad	int	%	Percent load at current speed	√	√
engineTorque	int		Maximum engine torque	X	√
engineStarter	bool_t	/	Engine starter active	X	√
intercoolerTemperature	int	°C	Intercooler temperature	X	√
fluids					
hydraulicOilTemperature	int	°C	Hydraulic oil temperature	X	√
winchOilOverMinimum	bool_t	/	Winch oil over minimum	X	√
hydraulicOilLevel	int	%	Hydraulic oil level	X	√
engineFuelTemperature	float	°C	Engine fuel temperature	X	√
engineOilTemperature	float	°C	Engine oil temperature	X	√
turboOilTemperature	int	°C	Turbo oil temperature	X	√
engineOilLevel	float	%	Engine oil level	X	√
engineOilPressure	float	kPa	Engine oil pressure	X	√
engineCoolantTemperature	int	°C	Engine coolant temperature	√	√

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engineCoolantPressure	float	kPa	Engine coolant pressure	X	√
engineCoolantLevel	float	%	Engine coolant level	X	√
ptoOilTemperature	float	°C	PTO oil temperature	X	√
washerLevel	float	%	Washer liquid level	X	√
transmissionOilLevel	float	%	Transmission oil level	X	√
transmissionOilPressure	float	kPa	Transmission oil pressure	X	√
transmisisonOilTemperature	float	°C	Transmission oil temperature	X	√
AirSupply					
pneumaticAirPressure	float	kPa	Pressure in main reservoir	X	√
parkingTrailerAirPressure	float	kPa	Parking air brake pressure	X	√
auxiliaryEquipmentPressure	float	kPa	Auxiliary air pressure	X	√
airSuspensionPressure	float	kPa	Air suspension pressure	X	√
airCompressorEnabled	bool_t	/	Air compressor enabled	X	√
vehicleWeight					
axleLocation	int	/	Axle number (front to back)	√	√
axleWeight	float	kg	Axle weight	√	√
tireLocation	int	/	Tire number (From left to right)	√	X
trailerWeight	float	kg	Weight on trailer	X	√
cargoWeight	float	kg	Weight of cargo	X	√
pedals					
clutchSwitch	pedalState_t	/	Clucht state	√	√
brakeSwitch	pedalState_t	/	Brake state	√	√
acceleratorPosition	int	%	Pressure of accelerator	√	√
remoteAcceleratorPressure	int	%	Remote accelerator pressure	X	√
lights					
workLight	bool_t	/	Work light enabled	X	√
mainLight	bool_t	/	Main light enabled	X	√
turnSignal	bool_t	/	Turn signal enabled	X	√
hazardLight	bool_t	/	Hazard light enabled	X	√
highBeamEnabled	bool_t	/	High beam enabled	X	√
Navigation					
vehicleMoving	bool_t	/	Vehicle moving	√	√
direction	direction_t	/	Direction of vehicle	√	√
wheelBasedSpeed	int	km/h	Wheel speed	√	√
Overspeed	bool_t	/	Overspeed passed	√	√
tachographicSpeed	int	km/h	Tachographic speed	√	√
cruiseControlActive	bool_t	/	Cruise control active	√	√
cruiseControlSetSpeed	int	km/h	Speed set in cruise control	X	√
roadSpeedLimitStatus	bool_t	/	Road speed limit enabled	X	√

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Transmission					
currentGear	int	/	Current gear	X	√
gearRatio	float	/	Transmission input to output shaft speed	X	√
reverseSwitch	bool_t	/	Reverse switch enabled	X	√
neutralSwitch	bool_t	/	Neutral switch enabled	X	√
forwardSwitch	bool_t	/	Forward switch enabled	X	√
differentialLock	Substructure, see fields below				
frontAxle1	bool_t	/	Differential lock on front axle 1	X	√
frontAxle2	bool_t	/	Differential lock on front axle 2	X	√
rearAxle1	bool_t	/	Differential lock on rear axle 1	X	√
rearAxle2	bool_t	/	Differential lock on rear axle 2	X	√
central	bool_t	/	Central differential lock	X	√
frontCentral	bool_t	/	Front central differential lock	X	√
rearCentral	bool_t	/	Rear central differential lock	X	√
vehicleState					
ptoActive	bool_t	/	PTO enabled	√	√
ptoSpeed	int	rpm	PTO speed	X	√
vehicleDistance	long	km	Vehicle distance	√	√
serviceDistance	int	km	Service distance	√	√
parkingBrakeSwitch	bool_t	/	Parking brake switch enabled	X	√
cargoAmbientTemperature	float	°C	Cargo ambient temperature	X	√
auxiliaryWaterPumpPressure	float	kPa	Auxiliary water pump pressure	X	√
InletExhaust					
particulateTrapInletPressure	float	kPa	Particulate trap inlet pressure	X	√
turbochargerBoostPressure	float	kPa	Turbo boost pressure	X	√
engineAirInletPressure	float	kPa	Engine air inlet pressure	X	√
exhaustGasTemperature	float	kPa	Exhaust gas pressure	X	√
ElectricalPowerX					
batteryCurrent	float	A	Battery current	X	√
alternatorCurrent	float	A	Alternator current	X	√
chargingSystemVoltage	float	V	Charging voltage	X	√
electricalVoltage	float	V	Electrical system voltage	X	√

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batteryVoltage	float	V	Battery voltage	X	√
ambient					
airTemperature	float	°C	Air temperature	√	√
barometricPressure	float	kPa	Air pressure	X	√
cabineTemperature	float	°C	Cabine temperature	X	√
inductedAirTemperature	float	°C	Inducted air temperature	X	√
roadTemperature	float	°C	Road temperature	X	√
driver					
driver1CardPresent	bool_t	/	Driver 1 card	√	√
driver1WorkingState	driverState_t	/	Driver 1 state	√	√
driver2CardPresent	bool_t	/	Driver 2 card	√	√
driver2WorkingState	driverState_t	/	Driver 2 state	√	√

canSettings_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
can0		
baudrate	int	CAN bus baudrate
protocol	canProtocol_t	Can protocol to use
can1		
baudrate	int	CAN bus baudrate
protocol	canProtocol_t	Can protocol to use

2.3.3 Functions

abGPS	
Funzione	**Descrizione**
abCAN_PowerOn	Power on the hardware
abCAN_PowerOff	Power off the hardware
abCAN_Settings	Set the parameters for a correct CAN comunication
abCAN_Start	Starts parser
abCAN_Stop	Stops parser
abCAN_Read	Reads CAN data

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2.3.3.1 abCAN_PowerOn

DESCRIPTION

Power on the CAN hardware and initialize the library

DEFINITION

abError_t abCAN_PowerOn( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_PRODCHECKERROR:** Cannot check hardware type

2.3.3.2 abCAN_PowerOff

DESCRIPTION

Deinitialize the library and power off the hardware

DEFINITION

abError_t abCAN_PowerOff( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured

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2.3.3.3 abCAN_Settings

DESCRIPTION

Set the parameters for a correct CAN comunication

DEFINITION

abError_t abCAN_Settings(canSettings_t settings)

PARAMETERS

- **settings:** settings to apply

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** Library not initialized
- **ABERR_OPERROR:** Cannot apply settings

2.3.3.4 abCAN_Start

DESCRIPTION

Starts the data parser based on protocols defined in the settings function

DEFINITION

abError_t abCAN_Start( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** Cannot communicate with bus
- **ABERR_OPERROR:** Cannot start parser

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2.3.3.5 abCAN_Stop

DESCRIPTION

Stops the data parser based on protocols defined in the settings function

DEFINITION

abError_t abCAN_Stop( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized
- **ABERR_SEMERROR:** Error in synchronization system

2.1.3.6 abCAN_Read

DESCRIPTION

Returns the data provided by the CAN bus

DEFINITION

abError_t abCAN_Read(canData_t* can0Data, canData_t* can1Data)

PARAMETERS

- **can0Data:** pointer to a canData_t structure where the values found on can0 interface will be stored. Use a NULL pointer if you don't want to get these data
- **can1Data:** pointer to a canData_t structure where the values found on can1 interface will be stored. Use a NULL pointer if you don't want to get these data

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_VALERROR:** both pointers are NULL pointers
- **ABERR_INITERROR:** Library isn't initialized

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2.3.4 Examples

2.3.4.1 CAN data monitor

This example reads and print on screen some CAN data for 5 minutes:

```
#include <stdio.h>
#include <string.h>
#include "abCAN.h"
#include "baseTypes.h"

int main(){

    int i;
    canData_t canData;
    canSettings_t canSettings;
    abError_t err;

    // Power on the GPS module and initializes the library

    abCAN_PowerOn();

    settings.can0.baudrate = 50000;
    settings.con0.protocol = PR_J1939;
    settings.can1.baudrate = 0;
    settings.can1.protocol = PR_NONE;
    abCAN_Settings(settings);

    abCAN_Start();

    i = 0;
    while(i<300){

        err = abCAN_Read(&canData, NULL);
        if (err == ABERR_OK){
            printf("Wheel speed: %d km/h with %d rpm in %dth gear\n",
                    canData.navigation.wheelBasedSpeed, canData.engine.engineSpeed,
                    canData.transmission.currentGear);
        }
        sleep(1);
        i++;
    }

    abCAN_Stop();
    abCAN_PowerOff();

    return 0;
}
```


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2.4 abDIO

The abDIO library includes all functions to control the digital inputs and outputs

2.4.1 Constants

dioState_t		
NAME	**VALUE**	**DESCRIPTION**
DIOS_UNKNOWN	-1	Unknown state
DIOS_OFF	0	Off (0 value)
DIOS_ON	1	On (1 value)
DIOS_FLOAT	2	Floating state

dioOutput_t		
NAME	**VALUE**	**DESCRIPTION**
DIOD_DOUT1	0	DOUT1
DIOD_DOUT2	1	DOUT2
DIOD_DOUT3	2	DOUT3
DIOD_DOUT4	3	DOUT4
DIOD_RELAYA	4	RELAY A
DIOD_RELAYB	5	RELAY B
DIOD_LEDRED	6	RED LED
DIOD_LEDGREEN	7	GREEN LED

2.4.2 Data structures

dioData_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
inputs		
din1	dioState_t	Digital input 1 state
din2	dioState_t	Digital input 2 state
din3	dioState_t	Digital input 3 state
din4	dioState_t	Digital input 4 state *
din5	dioState_t	Digital input 5 state * **
din6	dioState_t	Digital input 6 state * **

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din7	dioState_t	Digital input 7 state * ** ***
din8	dioState_t	Digital input 8 state * ** ***
outputs		
dout1	dioState_t	Digital output 1
dout2	dioState_t	Digital output 2 * ***
dout3	dioState_t	Digital output 3 * ***
dout4	dioState_t	Digital output 4 * ** ***
relayA	dioState_t	Relay A
relayB	dioState_t	Relay B
ledRed	dioState_t	Red Led ****
ledGreen	dioState_t	Green Led ****

* *Not available on ABT20*
** *Not available on ABT40*
*** *Not available on ABT21*
**** *Available only on ABT21*

2.4.3 Functions

abDIO	
Funzione	**Descrizione**
abDIO_Initialize	Power on the module and initialize the library
abDIO_Uninitialize	Power off the module and uninitialize the library
abDIO_Read	Reads the current state of I/O's
abDIO_Write	Sets a new I/O state

2.4.3.1 abDIO_Initialize

DESCRIPTION
Initialize the library

DEFINITION
abError_t abDIO_Initialize( )

PARAMETERS
-

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RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_PRODCHECKERROR:** Cannot check hardware type
- **ABERR_SEMERROR:** error in synchronizing system

2.4.3.2 abDIO_Unitialize

DESCRIPTION

Deinitialize the library

DEFINITION

abError_t abDIO_Uninitialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_SEMERROR:** error in synchronizing system

2.4.3.3 abDIO_Write

DESCRIPTION

Sets the I/O's state

DEFINITION

abError_t abDIO_Write(dio Output_t output, dioState_t value)

PARAMETERS

- **output:** device which must be written
- **value:** value to apply

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RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized
- **ABERR_VALERROR:** Wrong value to apply
- **ABERR_IOERROR:** Cannot write

2.4.3.4 abDIO_Read

DESCRIPTION

Reads the current I/O's values

DEFINITION

abError_t abDIO_Read(dioData_t* dioData)

PARAMETERS

- **dioData:** pointer to a structure for store the current values

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized

2.4.4 Examples

2.4.4.1 DOUT lighting system

This example checks status of DIN1. When it goes in a ON state, DOUT1 start blinking.

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```
#include <stdio.h>
#include <string.h>
#include "abDIO.h"
#include "baseTypes.h"

int main(){

    dioData_t dioData;
    abError_t err;

    abDIO_Initialize();

    while(1){

       abDIO_Write(DIOD_DOUT1, DIOS_OFF);
       sleep(1);

       abDIO_Read(&dioData);

       if (dioData.inputs.din1 == DIOS_ON){
            abDIO_Write(DIOD_DOUT1, DIOS_ON);
            sleep(1);
        }
    }

    abDIO_Uninitialize();

    return 0;
}
```


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2.5 abPWR

The abPWR library includes all functions to control the power supply system, that means main power and internal battery.

2.5.1 Constants

battState_t		
NAME	**VALUE**	**DESCRIPTION**
BATT_FAULT	-1	Battery in a fault state
BATT_NOCHARGE	0	Battery not charging
BATT_CHARGE	1	Battery charging

2.5.2 Data structures

pwrData_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
mainPowerLevel	float	Level of main power (Volts)
batteryLevel	float	Battery charge level (Volts)
batteryState	battState_t	State of the battery

2.5.3 Functions

abPWR	
Funzione	**Descrizione**
abPWR_Initialize	Initialize the library
abPWR_Uninitialize	Uninitialize the library
abPWR_Read	Reads the current power state
abPWR_StartBatteryCharge	Starts battery charge
abPWR_StopBatteryCharge	Stop charging battery

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2.5.3.1 abPWR_Initialize

DESCRIPTION

Initialize the library

DEFINITION

abError_t abPWR_Initialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_PRODCHECKERROR:** Cannot check hardware type

2.5.3.2 abPWR_Unitialize

DESCRIPTION

Deinitialize the library

DEFINITION

abError_t abPWR_Uninitialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured

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2.5.3.3 abPWR_Read

DESCRIPTION

Reads the current power state

DEFINITION

abError_t abPWR_Read(pwrState_t* state)

PARAMETERS

- **state:** pointer to a data structure for store the values

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized
- **ABERR_OPERROR:** Cannot check power status
- **ABERR_IOERROR:** Cannot read power levels

2.5.3.4 abPWR_StartBatteryCharge

DESCRIPTION

Starts charging the battery

DEFINITION

abError_t abPWR_StartBatteryCharge( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_OPERROR:** cannot start charge

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2.5.3.5 abPWR_StopBatteryCharge

DESCRIPTION

Stops charging the battery

DEFINITION

abError_t abPWR_StopBatteryCharge( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_OPERROR:** cannot stop charge

2.5.4 Examples

2.5.4.1 Battery charging system

This example checks main power level. If it is higher than 10V, battery charge will be enabled.

```
#include <stdio.h>
#include <string.h>
#include "abPWR.h"
#include "baseTypes.h"

int main(){

    pwrData_t pwrData;
    abError_t err;

    abDIO_Initialize();
```


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```
    while(1){

       sleep(1);
       abPWR_Read(&pwrData);

       if (pwrData.mainPowerLevel >= 10.0){
           if (pwrData.batteryState == BATT_NOCHARGE)
                abPWR_StartBatteryCharge();
       }else{
           abPWR_SopBatteryCharge();
       }
    }

    abPWR_Uninitialize();

    return 0;
}
```


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2.6 abSYS

The abSYS library includes all functions to control the system functionalities as RTC clock, sleep states and watchdog.

2.6.1 Constants

wakeupDevices_t		
NAME	**VALUE**	**DESCRIPTION**
WKD_UNKNOWN	0	Unknown wakeup device
WKD_DIN1HI	1	DIN 1 High level (1 value)
WKD_DIN1LOW	2	DIN 1 Low level (0 value)
WKD_DIN2HI	3	DIN 2 High level (1 value)
WKD_DIN2LOW	4	DIN 2 Low level (0 value)
WKD_DIN3HI	5	DIN 3 High level (1 value)
WKD_DIN3LOW	6	DIN 3 Low level (0 value)
WKD_DIN4HI	7	DIN 4 High level (1 value) *
WKD_DIN4LOW	8	DIN 4 Low level (0 value) *
WKD_DIN5HI	9	DIN 5 High level (1 value) * ****
WKD_DIN5LOW	10	DIN 5 Low level (0 value) * ****
WKD_DIN6HI	11	DIN 6 High level (1 value) * ****
WKD_DIN6LOW	12	DIN 6 Low level (0 value) * ****
WKD_POWERFAULT	13	Power fault
WKD_BATTFAULT	14	Battery fault * ** *****
WKD_BATTCHARGE	15	Battery charge * ** *****
WKD_MOVEMENT	16	Movement sensor
WKD_RTC	17	RTC alarm
WKD_COM2DATA	18	COM2 Data * *** *****
WKD_COM3DATA	19	COM3 Data * ** *****
WKD_COM4DATA	20	COM4 Data * ** *****
WKD_GSM1RING	21	GSM1 ring
WKD_GSM2RING	22	GSM2 ring * ** *****
WKD_GPSANTENNA	23	GPS antenna * **

* *Not available on ABT20*
** *Not available on ABT40*
*** *Not available on ABT50*
**** *Available only on ABT21*
***** *Not available on ABT21*

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sleepType_t		
NAME	**VALUE**	**DESCRIPTION**
ST_NORMAL	0	Normal sleep
ST_DEEP	1	Deep sleep (all applications are killed and the system turn down) *

* *Not available on ABT20 and ABT40*

2.6.2 Data structures

sysData_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
timeDate	timeDate_t	Current system date and time
temperature	int	Internal temperature *

* *Not available on ABT20 and ABT40*

2.6.3 Functions

abSYS	
Funzione	**Descrizione**
abSYS_Initialize	Initialize the library
abSYS_Uninitialize	Uninitialize the library
abSYS_Sleep	Puts the system in a sleep stste, and returns, on wakeup, the wakeup reason
abSYS_Read	Reads the system state
abSYS_SetTimeDate	Sets system time date
abSYS_SetAlarm	Sets an RTC alarm
abSYS_DisableAlarm	Disable RTC alarm
abSYS_EnableWatchdog	Enable watchdog
abSYS_PulseWatchdog	Give a pulse to watchdog
abSYS_Wakeup2String	Converts a wakeup constant to its String representation

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2.6.3.1 abSYS_Initialize

DESCRIPTION

Initialize the library

DEFINITION

abError_t abSYS_Initialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_PRODCHECKERROR:** Cannot check hardware type

2.6.3.2 abSYS_Unitialize

DESCRIPTION

Deinitialize the library

DEFINITION

abError_t abSYS_Uninitialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured

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2.6.3.3 abSYS_Sleep

DESCRIPTION

Puts the system in a sleep stste, and returns, on wakeup, the wakeup reason
NOTE: Especially on ABT21 terminals is better to call the standby functions of other libraries if in use and after that puts terminal in a sleep state.

DEFINITION

abError_t abSYS_Sleep(wakeupDevices_t* deviceList, int numDevices, sleepType_t sleepType, wakeupDevices_t* wakeupReason)

PARAMETERS

- **deviceList:** array of wakeup devices, defining which devices can wakeup the system
- **numDevices:** length of device list
- **sleepType**: type of sleep
- **wakeupReason:** pointer to a variable where the wakeup device will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized
- **ABERR_VALERROR:** Wakeup list is empty
- **ABERR_IOERROR:** Cannot put system in sleep

2.6.3.4 abSYS_Read

DESCRIPTION

Reads the system state

DEFINITION

abError_t abSYS_Read(sysData_t* sysData)

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PARAMETERS

- **sysData:** pointer to a structure where the state will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot read the state

2.6.3.5 abSYS_SetTimeDate

DESCRIPTION

Sets the system time and date

DEFINITION

abError_t abSYS_SetTimeDate(timeDate_t timeDate)

PARAMETERS

- **timeDate:** time and date to set

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_OPERROR:** cannot set time because alarm is enabled
- **ABERR_IOERROR:** cannot set time

2.6.3.6 abSYS_SetAlarm

DESCRIPTION

Sets the RTC alarm

DEFINITION

abError_t abSYS_SetAlarm(timeDate_t alarm)

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PARAMETERS

- **timeDate:** alarm to set

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot set alarm

2.6.3.7 abSYS_DisableAlarm

DESCRIPTION

Disable the RTC alarm

DEFINITION

abError_t abSYS_DisableAlarm( )

PARAMETERS

- **timeDate:** alarm to set

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot disable alarm

2.6.3.8 abSYS_EnableWatchdog

DESCRIPTION

Enable the watchdog system. Once enabled, it cannot be disabled anymore, and it must be pulsed; if it is not pulsed for three minutes, the system will reboot itself.

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DEFINITION

abError_t abSYS_EnableWatchdog( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot enable watchdog

2.6.3.9 abSYS_PulseWatchdog

DESCRIPTION

Sends a pulse to the watchdog

DEFINITION

abError_t abSYS_PulseWatchdog( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot pulse watchdog
- **ABERR_OPERROR:** cannot access to watchdog

2.6.3.10 abSYS_Wakeup2String

DESCRIPTION

Converts a wakeup constant into its string representation

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DEFINITION

char* abSYS_Wakeup2String(wakeupDevices_t device)

PARAMETERS

- **device:** a wakeup constant

RETURN VALUES

-

2.6.4 Examples

2.6.4.1 Three minutes sleep

This example puts the system in a sleep state for three minutes, or a movement event.

```
#include "abSYS.h"
#include "baseTypes.h"

int main(){

    sysData_t sysData;
    abError_t err;
    wakeupDevices_t wakeupReason;

    wakeupDevices_t wkList[2];
    wkList[0] = WKD_RTC;
    wkList[1] = WKD_MOVEMENT;

    abSYS_Initialize();

    abSYS_Read(&sysData);
    sysData.timeDate.minutes = sysData.timeDate.minutes + 3;
    abSYS_SetAlarm(sysData.timeDate);

    abSYS_Sleep(wkList, 2, ST_NORMAL, &wakeupReason));

    abSYS_Uninitialize();
    return 0;
}
```


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2.7 abMSR

The abMSR library includes all functions to control the analog measurements that can be done by inputs or on-board sensors

2.7.1 Constants

accScale_t						
NAME	VALUE	DESCRIPTION				
		ABT20	*ABT40 version < 5*	*ABT40 version 5/6*	*ABT40 Version 12*	*ABT50 ABT21*
ACC_LOW	0	1.5G	2.5G	1.5G	2G	2G
ACC_MEDIUM	1	2G	3.3G	2G	4G	4G
ACC_HI	2	4G	6.7G	4G	8G	8G
ACC_VERYHI	3	6G	10G	6G	8G	8G

2.7.2 Data structures

accData_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
x	float	X Axis
y	float	Y Axis
z	float	Z Axis

gyrData_t *		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
x	float	X Axis
z	float	Z Axis

* *Not available on ABT20,ABT21 and ABT40*

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analogData_t ***		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
analogInput1	float	Analog input 1
analogInput2	float	Analog input 2 *
analogInput3	float	Analog input 3 * **
analogInput4	float	Analog input 4 * **

* *Not available on ABT20*
** *Not available on ABT40 and ABT21*
*** *On ABT21 terminals analogs can reach 30V, other terminals 15V*

odoData_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
speed	float	Odometer based speed [km/h]
distance	float	Odometer based trip distance [km]

msrSettings_t		
FIELD NAME	**DATA TYPE**	**DESCRIPTION**
acceleratorScale	accScale_t	Scale of acceleration (see table)
odometerCalibration	float	Calibration espresse in Meters per pulse
movementTreshold	int	On ABT21 terminals, movement sensor is implemented in the accelerator, and needs a threshold to work

2.7.3 Functions

abMSR	
Funzione	**Descrizione**
abMSR_Initialize	Initialize the library
abMSR_Uninitialize	Uninitialize the library
abMSR_Settings	Configure parameters for correct measurements
abMSR_ReadAnalogInputs	Read analog inputs value
abMSR_ReadAccelerometer	Read accelerometer
abMSR_ReadGyroscope	Read gyroscope
abMSR_StartOdometer	Start odometer routine and reset the trip counter
abMSR_StopOdometer	Stops odometer routine
abMSR_ReadOdometer	Read odometer values

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2.7.3.1 abMSR_Initialize

DESCRIPTION

Initialize the library

DEFINITION

abError_t abMSR_Initialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_PRODCHECKERROR:** Cannot check hardware type
- **ABERR_IOERROR:** Cannot initialize accelerometer

2.7.3.2 abMSR_Unitialize

DESCRIPTION

Deinitialize the library

DEFINITION

abError_t abMSR_Uninitialize( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_IOERROR:** Cannot deinitialize accelerometer

2.7.3.3 abMSR_Settings

DESCRIPTION

Sets the parameters for a correct measurement

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DEFINITION

abError_t abMSR_Settings(msrSettings_t settings)

PARAMETERS

- **settings:** data structure with settings to apply

RETURN VALUES

- **ABERR_OK:** Ok, no errors occured
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** Cannot configure

2.7.3.4 abMSR_ReadAnalogInputs

DESCRIPTION

Reads the analog inputs

DEFINITION

abError_t abMSR_ReadAnalogInputs(analogData_t* data)

PARAMETERS

- **data:** pointer to a structure where the values will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot read the state

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2.7.3.5 abMSR_ReadGyroscope

DESCRIPTION

Read the gyroscope values

DEFINITION

abError_t abMSR_ReadGyroscope(gyrData_t* data)

PARAMETERS

- **data:** pointer to a structure where the values will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot set time
- **ABERR_NOHARDWARE:** There is no hardware on the terminal

2.7.3.6 abSYS_ReadAccelerometer

DESCRIPTION

Reads the accelerometer

DEFINITION

abError_t abMSR_ReadAccelerometer(accDate_t* data)

PARAMETERS

- **data:** pointer to a structure where the values will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot set alarm
- **ABERR_NOHARDWARE:** Terminal hasn't accelerometer installed

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2.7.3.7 abMSR_StartOdometer

DESCRIPTION

Start the odometer routine and reset the trip counter

DEFINITION

abError_t abMSR_StartOdometer( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** cannot reset trip counter
- **ABERR_OPERROR:** Cannot start odometer routine
- **ABERR_SEMERROR:** error in synchronization system

2.7.3.8 abMSR_StopOdometer

DESCRIPTION

Stops the odometer routine

DEFINITION

abError_t abMSR_StopOdometer( )

PARAMETERS

-

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized
- **ABERR_IOERROR:** Cannot disable odometer

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- **ABERR_OPERROR:** Cannot stop odometer routine
- **ABERR_SEMERROR:** error in synchronization system

2.7.3.9 abMSR_ReadOdometer

DESCRIPTION

Read the odometer based values

DEFINITION

abError_t abMSR_ReadOdometer(odoData_t* data)

PARAMETERS

- **data:** pointer to a structure where the values will be stored

RETURN VALUES

- **ABERR_OK:** Ok, no errors occurred
- **ABERR_INITERROR:** library not initialized

2.7.4 Examples

2.7.4.1 Odometer based trip counter

This example implements an odometer based trip counter.

```
#include <stdio.h>
#include <string.h>
#include "abMSR.h"
#include "baseTypes.h"
```


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```
int main(){

    msrSettings_t settings;
    odoData_t odoData;

    abMSR_Initialize();

    settings.acceleratorScale = ACC_LOW;
    settings.odometerCalibration = 0.125;
    abMSR_Settings(settings);

    abMSR_StartOdometer(settings);


    while(1){
        abMSR_ReadOdometer(&odoData);
        printf("Trip km: %f km, current speed: %f km/h\n", odoData.distance,
                odoData.speed);
        sleep(1);
    }

    abMSR_StopOdometer(settings);
    abMSR_Uninitialize());
    return 0;
}
```


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