

# **ABT-SAPI User Manual**

Version 1.2.0

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ABT-SAPI-User manual-1.2.0

## 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)			
ahMCD	Analog measurements (analog inputs, accelerometer, gyroscope, odometer			
abMSR based speed and distance)				
abGSM Phone control functions, calls, SMS and PPP connection				
abCAN Can bus				

## 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 included 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



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			



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	



## 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





## 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





## 2.1.3.4 abGPS\_Restore

#### **DESCRIPTION**

Resume the GPS module from standby and restart the data collector

#### **DEFINITION**

abError tabGPS Restore(standbyType tstandby)

#### **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 tabGPS 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





## 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:dn, 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;
```



## 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 *

<sup>\*</sup>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



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 **

<sup>\*</sup> On ABT50 not amplified audio isn't available, and channel selection is forced to Handsfree

<sup>\*\*</sup> 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	



- 1		
	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)			
ррр					
apn	char[MAX_APN_SETTINGS_SIZE]	APN name			
apnUsername	char[MAX_APN_SETTINGS_SIZE]	APN username *			
apnPassword	char[MAX_APN_SETTINGS_SIZE]	APN password *			

<sup>\*</sup> 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		



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



## 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**

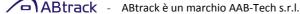
abError\_t abGSm\_ReadStatus(gsmDevice\_t device, gsmStatus\_t\* status )

#### **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





- 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])





#### **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**

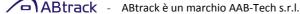
abError\_t abGSM\_CloseCall( gsmDevie\_t device)

#### **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





## 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





#### **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





#### **DEFINITION**

abError tabGSM SendSMS(gsmDevie tdevice, gsmSms tsms)

#### **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 tabGSM 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





## 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





## 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



## 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:\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;
}
```



## 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)){</pre>
                abGSM_DisconnectPPP(G_GSM1);
        sleep(1);
    abGSM_PowerOff();
    return 0;
```



## 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_CANO	0	Can 0 interface
C_CAN1	1	Can 1 interface *

<sup>\*</sup> 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



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	٧	٧	
fuelEconomy	float	km/L	Fuel economy at current speed	٧	٧	
averageFuelEconomy	float	km/L	Average fuel economy	Х	٧	
fuelLevel	float	L	Current fuel level	٧	٧	
totalFuelUsed	float	L	Total fuel used	٧	٧	
tripFuelUsed	float	L	Fuel used in current journey	Х	٧	
fuelDeliveryPressure	float	kPa	Gage pressure of fuel	Х	٧	
		engine				
engineSpeed	int	rpm	Engine speed	٧	٧	
engineThrottlePosition	float	%	Position of the throttle valve		٧	
engineHours	float	Н	Total engine hours	٧	٧	
engineLoad	int	%	Percent load at current speed	٧	٧	
engineTorque	int		Maximum engine torque	Х	٧	
engineStarter	bool_t	/	Engine starter active	Х	٧	
intercoolerTemperature	int	°C	Intercooler temperature	Х	٧	
		fluids				
hydraulicOilTemperature	int	°C	Hydraulic oil temperature	Х	٧	
winchOilOverMinimum	bool_t	/	Winch oil over minimum	Х	٧	
hydraulicOilLevel	int	%	Hydraulic oil level	Х	٧	
engineFuelTemperature	float	°C	Engine fuel temperature	Х	٧	
engineOilTemperature	float	°C	Engine oil temperature	Х	٧	
turboOilTemperature	int	°C	Turbo oil temperature	Х	٧	
engineOilLevel	float	%	Engine oil level	Х	٧	
engineOilPressure	float	kPa	Engine oil pressure	Х	٧	
engineCoolantTemperature	int	°C	Engine coolant temperature	٧	٧	



engineCoolantPressure	float	kPa	Engine coolant pressure	Х	٧
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	√ √
transmissionom ressure	Hoat		Transmission oil	X	√ √
transmisisonOilTemperature	float	°C	temperature	^	V
	A	irSupply	temperature		
pneumaticAirPressure	float	kPa	Pressure in main reservoir	Х	٧
parkingTrailerAirPressure	float	kPa	Parking air brake pressure	Х	٧
auxiliaryEquipmentPressure	float	kPa	Auxiliary air pressure	Х	٧
airSuspensionPressure	float	kPa	Air suspension pressure	Х	٧
airCompressorEnabled	bool t	/	Air compressor enabled	Х	٧
P	-	cleWeigl			
		,	Axle number (front to	٧	٧
axleLocation	int	/	back)		
axleWeight	float	kg	Axle weight	٧	٧
		,	Tire number (From left to	٧	Х
tireLocation	int	/	right)		
trailerWeight	float	kg	Weight on trailer	Х	٧
cargoWeight	float	kg	Weight of cargo	Х	٧
		pedals			
clutchSwitch	pedalState_t	/	Clucht state	٧	٧
brakeSwitch	pedalState_t	/	Brake state	٧	٧
acceleratorPosition	int	%	Pressure of accelerator	٧	٧
remoteAcceleratorPressure	:	0/	Remote accelerator	Х	٧
remoteAcceleratorPressure	int	%	pressure		
		lights			
workLight	bool_t	/	Work light enabled	Χ	٧
mainLight	bool_t	/	Main light enabled	Х	٧
turnSignal	bool_t	/	Turn signal enabled	X	٧
hazardLight	bool_t	/	Hazard light enabled	Х	٧
highBeamEnabled	bool_t	/	High beam enabled	Х	٧
Navigation Navigation					
vehicleMoving	bool_t	/	Vehicle moving	٧	٧
direction	direction_t	/	Direction of vehicle	٧	٧
wheelBasedSpeed	int	km/h	Wheel speed	٧	٧
Overspeed	bool_t	/	Overspeed passed	٧	٧
tachographicSpeed	int	km/h	Tachographic speed	٧	٧
cruiseControlActive	bool_t	/	Cruise control active	٧	٧
cruiseControlSetSpeed	int	km/h	Speed set in cruise control	Х	٧
roadSpeedLimitStatus	bool_t	/	Road speed limit enabled	Х	٧





	Tra	nsmissio	n		
currentGear	int	/	Current gear	Х	٧
gearRatio	float	/	Transmission input to output shaft speed	Х	٧
reverseSwitch	bool t	/	Reverse switch enabled	Х	٧
neutralSwitch	bool t	/	Neutral switch enabled	Х	٧
forwardSwitch	bool_t	/	Forward switch enabled	Х	٧
differentialLock	<del>-</del>	Subs	tructure, see fields below		
frontAxle1	bool_t	/	Differential lock on front axle 1	Х	٧
frontAxle2	bool_t	/	Differential lock on front axle 2	Х	٧
rearAxle1	bool_t	/	Differential lock on rear axle 1	Х	٧
rearAxle2	bool_t	/	Differential lock on rear axle 2	Х	٧
central	bool_t	/	Central differential lock	X	٧
frontCentral	bool_t	/	Front central differential lock	Х	٧
rearCentral	bool_t	/	Rear central differential lock	X	٧
	vei	hicleState	2		
ptoActive	bool_t	/	PTO enabled	V	٧
ptoSpeed	int	rpm	PTO speed	X	٧
vehicleDistance	long	km	Vehicle distance	٧	٧
serviceDistance	int	km	Service distance	٧	٧
parkingBrakeSwitch	bool_t	/	Parking brake switch enabled	Х	٧
cargoAmbientTemperature	float	°C	Cargo ambient temperature	X	٧
auxiliaryWaterPumpPressure	float	kPa	Auxiliary water pump pressure	X	٧
	Inle	etExhaus	t		
particulate TrapInlet Pressure	float	kPa	Particulate trap inlet pressure	Х	٧
turbochargerBoostPressure	float	kPa	Turbo boost pressure	Х	٧
engineAirInletPressure	float	kPa	Engine air inlet pressure	Х	٧
exhaustGasTemperature	float	kPa	Exhaust gas pressure	Х	٧
	Elect	ricalPow	erX		
batteryCurrent	float	Α	Battery current	Х	٧
alternatorCurrent	float	Α	Alternator current	X	٧
chargingSystemVoltage	float	V	Charging voltage	X	٧
electricalVoltage	float	V	Electrical system voltage	X	٧





batteryVoltage	float	V	Battery voltage	Х	٧
ambient					
airTemperature	float	°C	Air temperature	٧	٧
barometricPressure	float	kPa	Air pressure	Х	٧
cabineTemperature	float	°C	Cabine temperature	Х	٧
inductedAirTemperature	float	°C	Inducted air temperature	Х	٧
roadTemperature	float	°C	Road temperature	Х	٧
driver					
driver1CardPresent	bool_t	/	Driver 1 card	<b>^</b>	٧
driver1WorkingState	driverState_t	/	Driver 1 state	٧	٧
driver2CardPresent	bool_t	/	Driver 2 card	٧	٧
driver2WorkingState	driverState_t	/	Driver 2 state	٧	٧

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			



## 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



## 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





# 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**

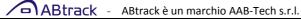
abError\_t abCAN\_Read( canData\_t\* can0Data, canData\_t\* can1Data)

### **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





# 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;
```



# **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 * **	



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 ****

<sup>\*</sup> Not available on ABT20

# 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**

-



<sup>\*\*</sup> Not available on ABT40

<sup>\*\*\*</sup> Not available on ABT21

<sup>\*\*\*\*</sup> Available only on ABT21



#### **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 tabDIO Write(dio Output toutput, dioState tvalue)

## **PARAMETERS**

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





### **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**

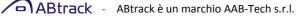
ABERR\_OK: Ok, no errors occured

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.





```
#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;
}
```



# 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	



# 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



# 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





# 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();
```

ABtrack - ABtrack è un marchio AAB-Tech s.r.l.



```
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;
}
```



# 2.6 abSYS

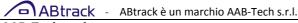
The abSYS library includes all functions to control the system functionalities as RTC clock, sleep states and watchdog.

# 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 * **

<sup>\*</sup> Not available on ABT20

<sup>\*\*\*\*\*</sup> Not available on ABT21



<sup>\*\*</sup> Not available on ABT40

<sup>\*\*\*</sup> Not available on ABT50

<sup>\*\*\*\*</sup> Available only on ABT21



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

<sup>\*</sup> 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	
ahsvs slaan	Puts the system in a sleep stste, and returns, on wakeup, the	
abSYS_Sleep	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	



# 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



# 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 tabSYS Read(sysData t\* sysData)



ABtrack - ABtrack è un marchio AAB-Tech s.r.l.



#### **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 tabSYS SetTimeDate(timeDate ttimeDate)

### **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

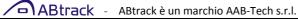
# 2.6.3.6 abSYS\_SetAlarm

### **DESCRIPTION**

Sets the RTC alarm

#### **DEFINITION**

abError\_t abSYS\_SetAlarm( timeDate\_t alarm )





#### **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.





#### **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 tabSYS PulseWatchdog()

## **PARAMETERS**

\_

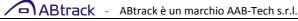
#### **RETURN VALUES**

- 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





#### **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;
```



# 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						
		DESCRIPTION				
NAME	VALUE	ABT20	ABT40	ABT40	ABT40	ABT50
			version < 5	version 5/6	Version 12	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	
х	float	X Axis	
У	float	Y Axis	
Z	float	Z Axis	

gyrData_t *			
FIELD NAME	DATA TYPE	DESCRIPTION	
Х	float	X Axis	
Z	float	Z Axis	

Not available on ABT20,ABT21 and ABT40



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 * **

<sup>\*</sup> Not available on ABT20

<sup>\*\*\*</sup> 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		

<sup>\*\*</sup> Not available on ABT40 and ABT21



# 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





### **DEFINITION**

abError tabMSR 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





# 2.7.3.5 abMSR\_ReadGyroscope

#### **DESCRIPTION**

Read the gyroscope values

### **DEFINITION**

abError tabMSR 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**

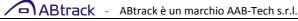
abError tabMSR ReadAccelerometer(accDate t\* data)

#### **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





# 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**

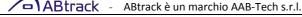
abError\_t abMSR\_StopOdometer()

#### **PARAMETERS**

-

#### **RETURN VALUES**

- ABERR\_OK: Ok, no errors occurred
- ABERR INITERROR: library not initialized
- ABERR\_IOERROR: Cannot disable odometer





- 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**

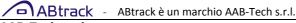
- ABERR\_OK: Ok, no errors occurred
- ABERR\_INITERROR: library not initialized

# 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"
```





```
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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