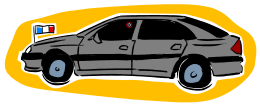
Communication Protocol
for Roadsay Vehicle Tracking Unit
- RS AVLs -



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Version

This manual is based on the RS AVL's fireware version 1.00.034(RS2100) and 2.00.006(RS3000).

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Chapter 1 Overview

This document specifies the communication protocol between the vehicle-mounted terminal and the communication gateway of Shenzhen Roadsay Technology Co., Ltd. The protocol describes the downlink messages from the center to RS AVL, and uplink messages from RS AVL to the center.

By default, RS AVL works in the GPRS mode, and transfers the messages between RS AVL and the center through TCP/IP protocol. When getting out of the GPRS signal coverage area, RS AVL can hand over to the SMS text mode automatically; when entering the GPRS signal coverage area again, RS AVL is re-connected to the center in the GPRS mode automatically. In the two transfer modes, the message format is the same as message contents, but the data frame format is different.

Chapter 2 Introduction of RS AVL

RS AVL is a kind of intelligent GPS vehicle tracking unit to support complete vehicle security and fleet management. It integrates a GPS receiver, a cellular network modem (GSM/GPRS/EDGE) and a built-in alarm system.

RS AVL has various vehicle sensors, and provides the customer with a vast variety of real-time activities and information about the vehicle, including camera picture, fuel consumption, etc. It monitors the vehicle at all times, and alerts the Control Center in case of theft or distress.

Additionally, standard multi RS232 interface and a two way communication modem, based on existing wireless infrastructure, makes RS AVLs possible to deploy the system with other value-added service, like transparent data transmission.

RS AVL is our best-selling product range, including RS3000B/B1/C/C1.

2.1 Specification

Measurement	102x68x42mm	600 grams

Cellular Modem	GSM 900/1800 or GSM850/1900	
Cellular Antenna	Dipole External	
Network	Data	GSM, GPRS and SMS
	Voice	Handset, Handsfree Kit
Messages	SMS	Encrypted Protocol
	GPRS	TCP/IP over PPP,UDP
GPS	Antenna External, connected via RJ11	
	Satellite Tracking	20 Parallel channels
	Protocol	NMEA (Binary format)
	Positioning accuracy	Position: 15m CEP(SA Off) Velocity: 0.2m/s
	Navigation Update Rate	1 second (Default)
	Time to First Fix (TTFF)	Hot Start: 2 sec' Warm Start: 35 sec' Cold Start: 50 sec'
I/O	Inputs	Emergency Button, 2xLow Level Analog, 2xHigh Level Analog, ACC Status, Engine Status, Door Status, Brake Status, Remote controller signal
	Outputs	Oil and electricity control, Siren,Central locking door,cornering lamp,over speed alarm,handsfree audio output
Alarm System	Hijack alarm, Anti-theft alarm,Power discarding, GPS antenna shourt circuit, GPS antenna open circuit, GPS receiver failure,illegal ignition, illegal door-opening, Voltage Analog Iput, Low battery voltage alarm,etc.	
Backup Battery	Optional	External , 12v 600mAh
	Backup Time	60~120minutes typically
Serial Port	RS232	For connecting external intelligent devices such as vehicle computers, PDA and any devices with serial communication modules
	Transfer rate (Baud)	9600 bps

2.2 Arming mode, Alarming mode and Burst mode

2.2.1 Arm and disarm the vehicle

RS AVL support three arming modes,disarming, prearming and arming.

Arming mode is setted by handset or remote control.RS AVL will keep prearming for 60

Seconds before changing to arming mode. A vehicle in arming mode can be disarmed by handset or remote controller. Engine can not be started in prearming mode or arming mode if security enhanced.

2.2.2 Alarm type and burst mode

RS AVL supports the following alarm types:

- ✓ GPS antenna open circuit alarm:GPS antenna happens to open circuit.
- ✓ GPS antenna short circuit alarm:GPS antenna happens to short circuit.
- ✓ GPS receiver failure:GPS module don't output data over 10s.
- ✓ Theft alarm: Open the door without entering correct password in 1 minute when the vehicle is armed.
- ✓ Password Error alarm: Enter wrong password over 3 times when the vehicle is armed.
- ✓ Power-discarding alarm: the main power is unavailable.
- ✓ Emergency alarm: Push the emergency button, some called hijack alarm
- ✓ Leaving Perimeter alarm: The car leave the defined geofence.
- ✓ Entering Perimeter alarm: The car enter the defined geofence.
- ✓ Over speed alarm: the vehicle's GPS speed is over speed limit.
- ✓ Illegal ignition alarm: Start engine when the vehicle is under arming mode.
- ✓ GPRS block alarm: Terminal cannt connect to the center over threshold of tries.
- ✓ Support the following customizable alarm:

  Door, Ignition, ACC, High Level sensor1(called H1 for short), High Level sensor2(called H2 for short); Low Level sensor1(called L1 for short), Low Level sensor2(called L2 for short), power supply by backup battery.

  These 8 alarm types can be defined by user, including the change mode of their status, sustained time after changed.

2.2.3 Alarm process

If bursting an alarm, RS AVL will send location&status report message automatically to the center every 30 seconds, at most 3 times, to remind the center to handle the alarm.

2.3 System functions configuration

There are 3 bytes, SYSSet0, SYSSet1 ,SYSSet2 and SYSSet3, indicating important functions' state. Every bit's value can be changed by 'C3' command.

SYSSet0		
Bits	Bit = 0	Bit = 1
Bit0	Enable oil&electricity control	Disable oil&electricity control
Bit1	Enable periodic location report by SMS	Disable periodic location report by SMS
Bit2	Enable the speed limit	Diable the speed limit
Bit3	Enable Perimeter alarm	Disable Perimeter alarm
Bit4	Forbid sniffer if no alarm burst	Permit sniffer if no alarm burst
Bit5 (Note1)	Enable to transmit SMS message by GPRS	Disable to transmit SMS message by GPRS
Bit6 (Note1)	Disable sending message by SMS	Enable to send messages by SMS
Bit7	Control the channel for transmitting SMS message by security alarms	Don't control the channel for transmitting SMS message by security alarms

Note1 :

Normally, the security alarm notification will be sent by SMS channel 3 times and by GPRS as 'V1' message if setting bit5='1' and bit6='1'.

SMS message is sent by SMS channel if you enalbe to send message by SMS.But if enabled to transmit SMS message by GPRS(bit5='0') , SMS message should be sent by GPRS to save money and transmit in time.

SYSSet1		
Bits	Bit = 0	Bit = 1
Bit0	Permit to call out	Forbid to call out
Bit1	Permit to be called	Forbid to be called
Bit2	Speed limitation with effective GPS data	Speed limitation without the validity of GPRS data
Bit3	Start S17 the when Perimeter alarm initiated	Don't start S17 the when Perimeter alarm initiated
Bit4	/	/
Bit5	Disable calling bar and called bar	Enable calling bar and called bar
Bit6	Disable to output GPS data	Enable to output GPS data

Bit7	/	/

SYSSet2		
Bits	Bit = 0	Bit = 1
Bit0	Forbid checking by user's mobile	Permit to be checked by user's mobile
Bit1	Forbid alarm notification to user's mobile	Permit alarm notification to user's mobile
Bit2 (Note1)	Forbid expanding information V0	Permit expanding information V0
Bit3 (Note2)	Disable privacy function	Enable privacy function
Bit4 (Note2)	Stop privacy function	Start privacy function
Bit5	No photo stored box	Having photo stored box
Bit6	Don't record driver's logon	Record driver's logon
Bit7	Don't judge the accident doubt by emergency brake	Judge the accident doubt by emergency brake

Note1: V0 will be replaced by V1 once Bit2 is '1'.

Note2: The center and user cant start privacy function information if bit3=0.

Note3: Normally, they are two levels limit to these function, permission to use the function at first and then start using the function as configured parameters.

SYSSet3		
bit	Bit = 0	Bit = 1
Bit0 （Note1）	Forbid extended auto-report message	Permit extended auto-report message
Bit1	/	/
Bit2	/	/
Bit3	/	/
Bit4	/	/
Bit5	/	/
Bit6	/	/
Bit7	/	/

Note1: extended auto-report message is a 32 bytes data packet ,began with 'T', in the wake of the standard data packet which is began with'$'.

2.4 Alert to user's mobile and check the vehicle's status by user's mobile

2.4.1 Alarm notification to user's mobile

Terminal will send alarm message to user's mobile once alarm happens if the function is active:

SMS Text	Mark
Anti-theft alarm	Anti-theft alarm
Hijack Alarm	Hijack Alarm
Password error	Type a wrong password
Illegal ignition alarm	Ignition when the vehicle is armed
Main Power Discard	Discard the main power supply
Perimeter Alarm	Entering or leaving per-defined geofence(spliced by pre-defined rectangular fence)
GPS failure	GPS antenna short or open circuit, something is wrong with GPS receiver
Other alarm	Over speed,GPRS block, customizable alarm and temperature alarm

2.4.2 Command for user's Mobile

Send 'A' to query the car state

SMS text	Marks
Normal	Car is in normal state.
Alarm Initiated	Terminal alarms.
Disarming	Security system is not working.
Arming	Security system is working.
Door open	Door is open
ACC Open	ACC open
Engine is running	Engine is running
Cut off the Oil&Electricity	Cut off oil&electricity supply
Power-supply by Backup Battery	Power supply by backup battery
Main Battery is discarded	Discard the vehicle's power supply
GPSAnt Open Circuit	GPS Open circuit
GPSAnt Short Circuit	GPS short circuit
H1	High Level sensor 1=1
H2	High Level sensor 2=1

L1	Low Level ensor 1 ground
L2	Low Level sensor 2 ground

Send 'B' to check alarm information

SMS Text	Marks
Anti-theft alarm	Theft alarm
Hijack Alarm	Emergency Alarm
Password error	Type wrong passwords over 3 times
Illegal ignition alarm	Ignition when the vehicle is armed
Main Power Discard	Discard the main power supply
Perimeter Alarm	Entering or leaving per-defined geofence
GPS failure	GPS antenna short or open circuit, something is wrong with GPS receiver
Other alarm	Over speed,GPRS block, customizable alarm and temperature alarm

Send 'C' to check location

SMS Text	Marks
Time:2006-05-09 12:22:35	Time2006-05-09 12:22:35
ELong:11056.1234	East Longitude110°56.1234′
NLat:2235.3456	North Latitude22°35.3456′
Speed: 23	Speed:23Km/Hour
Direction: 256.35	Drive direction 256.35°

2.5 GPRS Mode

2.5.1 Work mode

If IP address of the center is valid, GPRS is online and RS AVL always transmits data in the GPRS mode. Meanwhile RS AVL also can receive and send SMS message, answer or make a call.

When IP address is invalid:000.000.000.000 or GSM service is unavailable,terminal will be offline in GPRS mode.

2.5.2 Transmission channel

If GPRS is well connected with the center, there are 3 channels to communication between terminals and the center:

TCP command transfer channel:Format and content is the same as SMS and code is

ASCII.

TCP data transfer channel: Auto Report messages (as set by 'D1', 'V1' general message) are Binary. It is sent in the same socket with TCP command channel.

UDP Porotcol data transfer channel: S17 with UDP porotcol carrys data(V1 gereral information) by Binary system.

Channel 2 and 3 transfer V1(general information)by Binary system. It is 32 bytes every record.

Chapter 3 Communication Porotcol

3.1 Porotcol format

3.1.1 Format of the center downlink command (SMS and TCP)

*XX,YYYYYYYYYY,CMD,VVVVVV,PARA1,PARA2,…#

Description:

* command head;

XX Manufacturer indication， 2 ASCII characters，such as RS、DC、XY and so on. Terminals will check this byte. If they are difference with the memory of terminals', the instruction will be threwn away. Push the emergency button, terminal will report manufacturer information to the center.

, Sepearing code;

YYYYYYYYYY terminal serial code,Type ASCII characters that is less than 10, Example:000;

CMD command symbol;

VVVVVV signature code(General time mark)

PARA command parameter

end

These characters should be capital in spelling and is invalid with blank.

3.1.2 Report message from terminal to the centers (SMS and GPRS)

1) Confirm message for respond command(V4):

*XX,YYYYYYYYYY,V4,CMD,VVVVVV,HHMMSS,S,latitude,D,longitude,G,speed,direction,DDMMYY,VehStatus#

Notes:

* Command head;

XX Manufacturer,such as RS,DC,XY and so on;

, Seperating symbol;

YYYYYYYYYY Terminal serial code;

CMD Command confirmed by the center;

VVVVVV Command is confirming;

HHMMSS Terminal time,International Standard Time;

S Mark GPS data(A/V),A;GPS data is valid,V:GPS data is invalid;

Latitude: Format is DDFF.FFFF, DD:digree（00 ~ 90）,FF.FFFF:cent（00.0000 ~ 59.9999）;

D:Latitude marks(N:North,S:South);

longitude:Format is DDDFF.FFFF，DDD:digree(000 ~ 180)，FF.FFFF:cent(00.0000 ~ 59.9999);

G:Latitude mark(E:East,W:West);

Speed: Speed rang 000.00 ~ 999.99. Perhaps this bytes is blank,which means 0 Knot/h;

Direction: direction— It is build on define North,the min digree is 1°, Clockwise.Perhaps this bytes is blank,which means 0 digree.

DDMMYY: day/month/year;

VehStatus: vehicle status.Total is four bytes, which signs terminal state, car state and alarm working or not. Bit=0 effects. *Refer to '3.1.4 Vehicle Status- VehStatus'.*

end

2) General message(V1**):**

*XX,YYYYYYYYYY,V1,HHMMSS,S,latitude,D,longitude,G,speed,direction,DDMMYY,vehicle_status#

3) **Enhance general report message(V0)**:

If bit2 of SYSSet2 sets '1', 'V0' will replace V1 message.

*XX,YYYYYYYYYY,V0,HHMMSS,S,latitude,D,longitude,G,speed,direction,DDMMYY,

vehicle_status,Usr_alarm_flag,KTS#

Usr_alarm_flag:Customize alarm mode

KTS: mileage counter (Unit is 1852/3600meter);

Other character is the same with V1.

4) Photo-taken message(V2):

If RS AVL's cameras took a photo successfully,RS AVL will report a message like,

*XX,YYYYYYYYYY,V2,Photo No., VVVVV,HHMMSS,S, latitude,D,longitude,G,

speed, direction, DMMYY,vehicle_status#

Notes:

- Photo No.,the number to identify the photo
- VVVVVV, useless，'000000' generally

5) Other report message(V9):

*XX,YYYYYYYYYY,V9,Data1,Data2…Datan,VVVVVV,HHMMSS,S,latitude,D,longitu

de,G,speed,direction,DDMMYY,vehicle_status,Usr_alarm_flag,KTS#

Notes:

Data1…Datan, the kind of data and related parameters

a) Emergency Brake data report(C7)

This message will be reported if the speed-down in conterminous seconds has surpass the appointed value.difference

Data1:C7

Data2:the value of speed-down(knot)

VVVVVV:useless，'000000' generally

b) Driver ID logon data(C9)

When the driver enter the his ID, RS AVL will report this message to express his login or logout(the center should judge his login or logout by the engine's status)

Data1:C9

Data2:mode to be approved

Data3:driver ID

VVVVVV:useless，’000000’ generally

c) Drive’s Fatigue data (C11)

When the driver has driven over appointed time, RS AVL will report this message

Data1:C11

Data2:continuous driving time

Data3:Driver ID

VVVVVV:useless，’000000’ generally

3.1.3 Fomat of GPRS auto report message (TCP/UDP)

Standard mode code:

No.	00	01	02	03	04	05	06	07	08	09	0A	0B
Content	$	0x1030731001					0x050316			0x220902		
Notes	Head	Terminal serial code					time			date		
No.	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18
Content	0x22128745				0x03	0x113466574C					0x014028		
Notes	Latitude value				/	Longitude value,N,E,AV					Speed,direciton		
No.	19	1A	1B	1C	1D					1E	1F		
Content	0xFFFFFBFF				0x15					0x25	0x79		
Notes	VehStatus				Usr_alarm_flag					/	Record No		

Note:

‘$’(0x24):Head;

Time:0x050316，International standard time 05:03:16;

Date:0x220902， 22/09/2002

Longitude value: 0x22128745,22°12.8745′

Latitude Value: 0x113466574C，113°46.6574′. Its last byte(0x15) express

bit7654，the last bit of latitude value

bit3, 1:East Longitude, 0:West Longitude

bit2, 1:North latitude, 0:South latitude

bit1, 1:A valid GPS data，0:V invalid GPS data

bit0，/

Speed,direction: 0x014028, speed is 014 knot,direction is 028.

VehStatus: mark the vechile state in Binary.

Usr_alarm_flag: customizable alarm status.

Record No.: Record No. increases one per sms sent in Binary.

2100 Serial added milemeter function:

Mileage: mileage BCD code:$D_{11}D_{10}D_9D_8D_7D_6D_5D_4D_3D_2.D_1D_0$,but $D_{11}D_{10}D_9D_8D_7D_6D_5D_4$ bits is valid. 0x10 saves $D_{11}D_{10}$, 0x1E and 0x1F save $D_9D_8D_7D_6$，and 0x1D saves D_5D_4.In case user customizable alarm happens，0x1D saves customization alarm status, or it will save D_5D_4. Mileage equals $D_{11}D_{10}D_9D_8D_7D_6D_5D_4$*51.444(meter), Example: 03257915*51.444(meter)= 167600.18Km.

- ✧ In case the code head is 'M'or 'P', then 'M' packet is picture index and 'P' packet is picture data.To 'M' packet,the lower bits in 0x10 byte express picture format and the higher bits in 0x10 byte express picture module number, the content of 0x1E and 0x1F is '0xFF' . To 'P' packet, the content of 0x1E byte and 0x1F byte is picture number and block number. The 'P' packet data includes 32 bytes picture index and a block's data(512 bytes),totally 544bytes.
- ✧ In case the code head is 'L', the packet data is driver's logon data. then the content of 0x16~0x17 arenot speed and direction,but BCD code to express driver's ID.
- ✧ In case the code head is 'L', the packet data is driving record.
- ✧ In case the code head is 'D', the packet data is 512 bytes to record total 21 seconds data.The firt second's data is the same as '$' packet(32 bytes), the later 20 seconds' data is 480bytes(every second's data is 24 bytes as 0x06-0x1Dbyte in the '$' packe data. Refer to 'Config accident doubt data record(C12)'.

3.1.4 Extended auto-report message

If the bit0 of SYSSet3 is valued as '1' to permit extended auto-report message, An expaned auto-report message will be uploaded followed every standard '$' message(as aboved 3.1.3). The message is headed with 'T' and should be 32bytes totally.

Extended auto-report message is to upload the data collected via RS AVL com port. Typically, it upload the data of RS A/D value for temperature sensor,load sensor,fuel reader……

3.1.5 Vehicle status—VehStatus

VehStatus says Vechile status, and the following explain each bit:

No.	First byte		Second byte		Third byte		Fourth byte	
0	0	Temperture alarm	0	GPS Receiver error	0	Door open	0	Antitheft alarm
1	0	Password Error	1	/	0	Arm	0	Hijack alarm
2	0	GPRS block	1	/	0	ACC Off	0	Over-speed alarm
3	0	Cut off oil& Electricity supply	0	Backup battery working	0	Brake	0	Illegal ignition
4	0	Main power discard alarm	0	Main power discard	0	Emergency Brake	0	Entering Perimeter alarm
5	0	H 1=1	0	GPS antenna open circuit	0	Engine On	0	GPS antenna open circuit alarm
6	0	H 2=1	0	GPS antenna short circuit	0	Customizable alarm	0	GPS antenna short circuit alarm
7	0	L 1=0	0	L 2=0	0	Over Speed limit	0	Leaving Perimeter alarm

GPS antenna open circuit(GO),GPS antenna short circit(GS),Working state marks:

GO	GS	State
1	1	Working
1	0	Antenna short circuit
0	1	Antenna open circuit
0	0	Antenna error

Backup battery working (P1):If main power is less than 11V(12V battery) or 20V(24V battery), or more than 33V, backup battery works.

Main power discard (P2): Main battery's voltage is less than 6V.

(P1) and (P2) config:

P1	P2	State
1	1	Main power is normal and working
1	0	Main power supply error
0	1	The main power's voltage is lower or higher and backup battery works
0	0	The mainpower is discard and backup battery works

Cut off oil& Electricity supply : Oil&electricity is under control: ignition is not permitted if cutting off oil&electricity happens.

H1=1 Or H2=1 ,High level voltage alrm: High level sensor is power-on.

L1=0 or L2=0, Low level voltage alrm: low level sensor is grounding.

Door open alarm: Input of door open sensor is 0(Grounding)

ACC Off:ACC shut off power supply.

Arm:Vehicle is in prearming or arming mode.

Engine: Engine is running.

3.2 Config command

3.2.1 Setting user mobile number(C2)

Function: setting vehicle's user mobile to check the state and notify alarms(at most 4 phone number each terminal)

Format: *XX,YYYYYYYYYY,C2,HHMMSS,S,N,u_address#

Description:

S=0:Query,S= others: set.

N:mobile number serial = 0-3.

u_address#: mobile number

Eexample1:*RS,1234567890,C2,112233,1,0,13808833059#

--Set user mobile number as13808833059 into Unit0.

Response:

*RS,1234567890,V4,C2,0,13808833059,112233,083058,A,2232.9807,N,11355.2407,E,0.00,19

.16,090305,FFFFFBFF#

Example2:*RS,1234567890,C2,112233,0,0,00#

--Reading user phone number in unit 0.

Response:

*RS,1234567890,V4,C2,0,13808833059,112233,083058,A,2232.9807,N,11355.2407,E,0.00,19

.16,090305,FFFFFBFF#

-END-