

XT55 AVL Software Instructions

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User's Guide

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1 Overview of Document

XT55 is a Plug & Play GSM/GPS device, which contains a software application named AVL that can be configured. The concept of the device is based on a simple implementation for a wide range of applications with low costs and high flexibility. In particular it offers a fast development of systems solutions within the fields of:

- **Tracking**

The vehicle to be tracked is fitted with the module XT55 and an antenna. GPS satellites are continuously transmitting a radio message containing information, including when the data was sent, which satellite sent it and the current reliability of the system. The XT55-AVL fitted in the vehicle receives this information from at least 4 satellites and carries out the necessary calculations to determine its current position.

- **AVL**

The embedded GPS receiver into the module XT55 determines its current location, speed and heading. This data can be stored or can be directly transmitted to an operating centre. The terminal reports its position to the Base Station over GSM communications network. Current position can be displayed on a PC/PDA in digital maps.

Depending on the configuration, the device exchanges data with a server application (e.g. Mapping-Software, etc.). The module XT55 can be configured by the user via local RS232-interface or via remote GSM (air link).

At the core of the above-mentioned system solutions is a classical set-up with client-server architecture. In this scenario, the module XT55 represents the so-called mobile client (see Figure 1).

The integration of the module XT55 requires a clear definition:

- The characteristics of the integrated AVL software solution of the module XT55 as a client of the user solution, and the possibilities for configuration.
- The instruction command for communicating with the client as the main part of the server application

This document seeks to describe the module XT55 firmware and its possibilities for configuration, including the description, which is based on the Windows™ HyperTerminal configuration (terminal emulator program).

Furthermore, in this document you will find a detailed description of the instruction command, providing a foundation for the set-up of own server applications for communicating with the mobile client (XT55).

Figure 1 shows an example of a practical application.

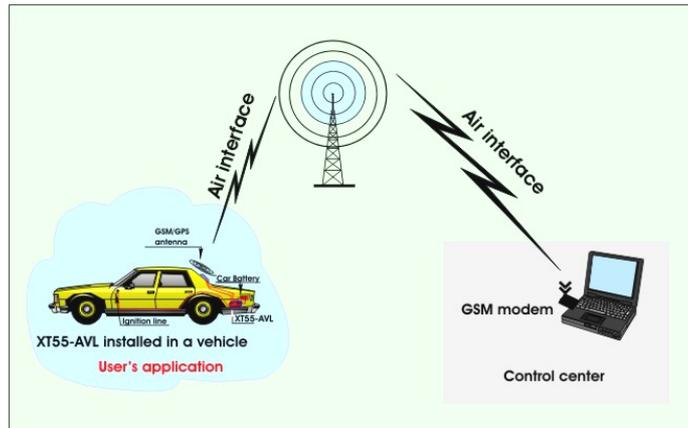


Figure 1: Simplified presentation of the AVL client-server architecture.

The connected GSM modem enables the communication to the XT55 (server side).

1.1 Hardware configuration

Please use the following hardware configuration to ensure the proper operation of the AVL application (see Figure 2).

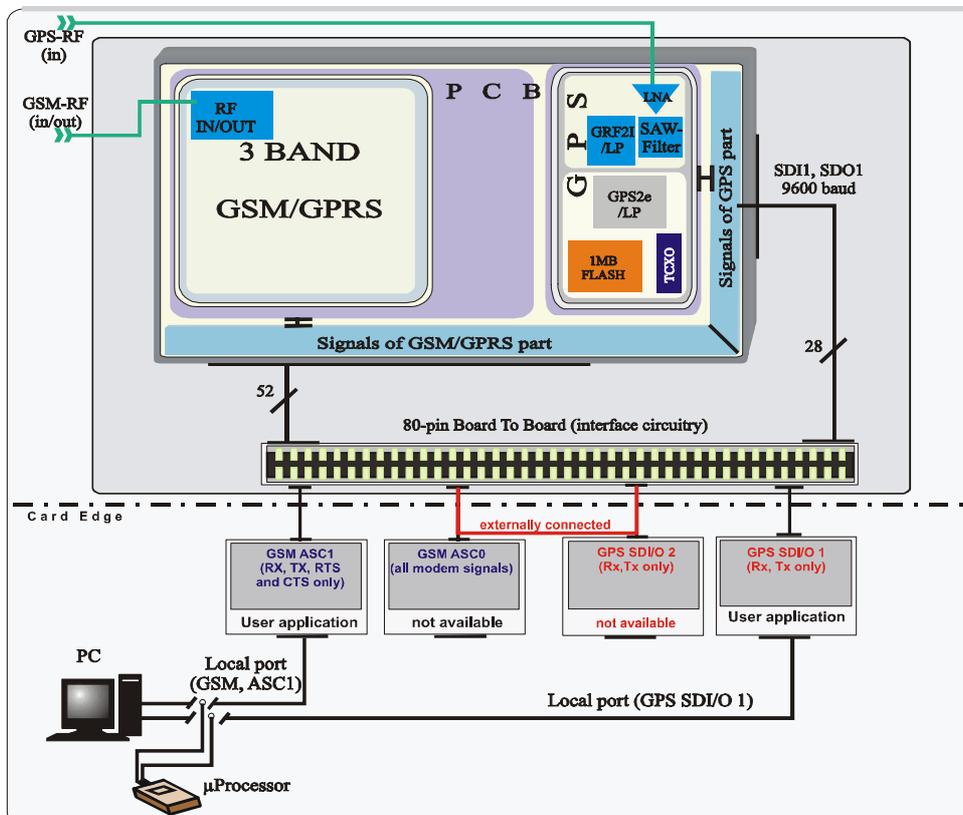


Figure 2: Block diagram of XT55 with AVL application

1.2 Related documents

- [1] XT55 AT Command Set
- [2] XT55 Hardware Interface Description
- [3] XT55 GPS Startup User's Guide
- [4] XT55 GPS Command Specification
- [5] GPRS Startup User's Guide
- [6] Remote-SAT User's Guide
- [7] DSB45 Support Box - Evaluation Kit for Siemens Cellular Engines
- [8] Application Note 07: Li-Ion Batteries in GSM Applications (in preparation)
- [9] Application Note 16: Upgrading XT55 Firmware (in preparation)
- [10] Application Note 14: Audio and Battery Parameter Download, (in preparation)
- [11] Application Note 02: Audio Interface Design, (in preparation)
- [12] Multiplexer User's Guide
- [13] Multiplex Driver Developer's Guide for Windows 2000 and Windows XP
- [14] Multiplex Driver Installation Guide for Windows 2000 and Windows XP
- [15] Application Note 24: Application Developer's Guide

Prior to using the XT55 engines or upgrading to a new firmware release, be sure to carefully read the latest product information.

To visit the Siemens Website you can use the following link:

<http://www.siemens.com/wm>

2 How to configure and evaluate the module XT55

The module XT55 GSM/GPS device allows a quick and uncomplicated configuration and evaluation by the user via local RS232-interface (directly connected to the serial port) or via remote (e.g. installed in a vehicle) GSM (air link).

With Windows™ HyperTerminal application (utility that is preinstalled on all versions of Windows 98, 98SE, Windows ME, Windows NT, and Windows 2000) it is possible to receive GPS position data and alarm status reports, as well as to execute a range of remote configurations.

If the module XT55 is configured remotely, prerequisite is the connection of a suitable GSM modem.

The configuration possibilities mainly cover the following areas:

1. GPS

- History function
 - Activation of predefined time and speed as a condition for storing position data in the internal history memory, as well as the option of remotely retrieving the history.
- GPS polling (NMEA commands, data calls)
 - NMEA command remote request the current status of alarms, start position request.
 - Start data calls directly to the GPS position surveillance of a module XT55.

2. Request the current status of GPIOs

- 2 I/O

2.1 Terminal emulator setup

Here below is an example based on the Windows™ HyperTerminal application (terminal emulator program).

The instructions below describe how to use the module XT55 with a PC running Windows 2000.

On the first time power-up you can use terminal software, which makes the communication with modem through a RS232 serial port possible. The following example is using the Hyper Terminal in Windows 2000.

On Windows 2000, start the Hyper Terminal program. Assign the name for a new session on the displayed window (e.g. XT55-AVL).

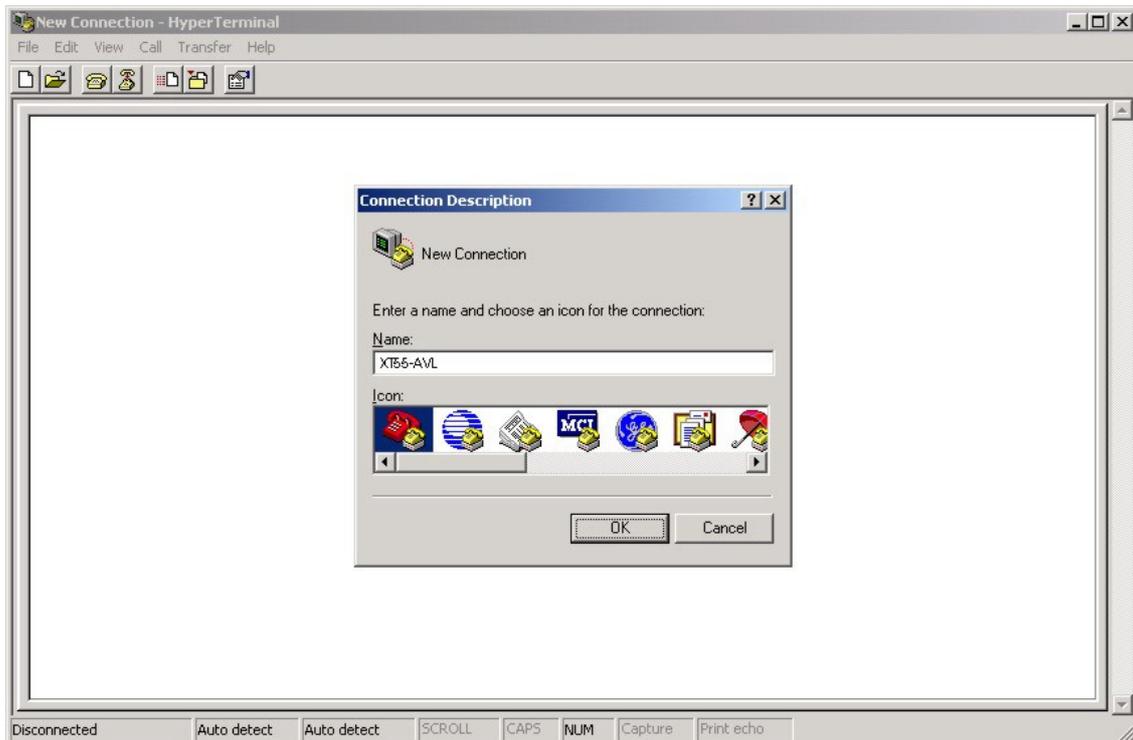


Figure 3: Assign the name for a new session

Choose the correct COM Port and baud rate settings (9600bps, 8 bit, no parity bit, 1 stop bit).

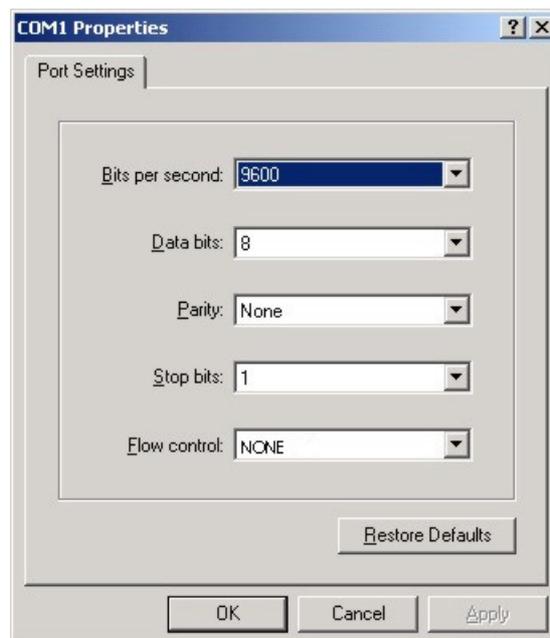


Figure 4: COM Port transmission settings

The connection to the connected module XT55 is created, the transmitted protocols are already displaying.

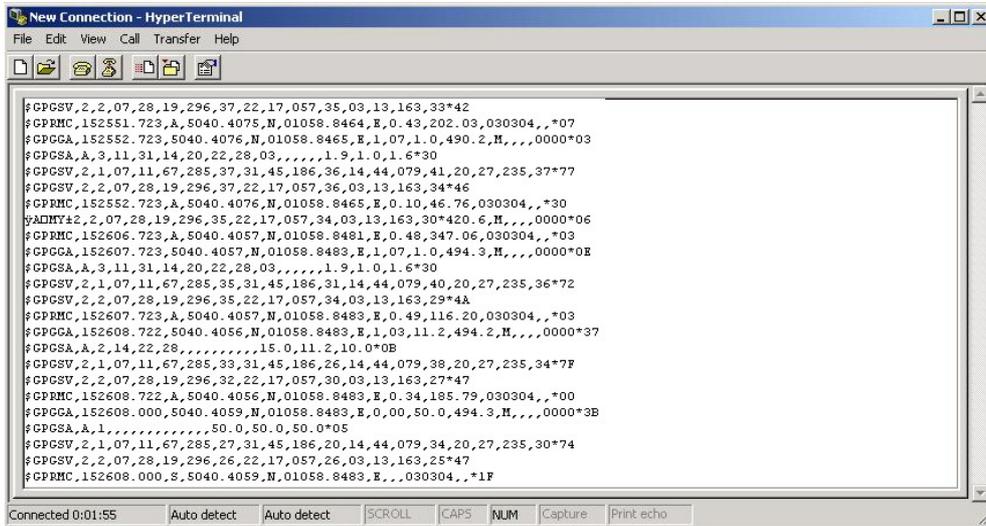


Figure 5: Displaying of the transmitted NMEA protocols

The next step, click the property button. Then select the settings tab sheet. Click the **ASCII setup...** button.

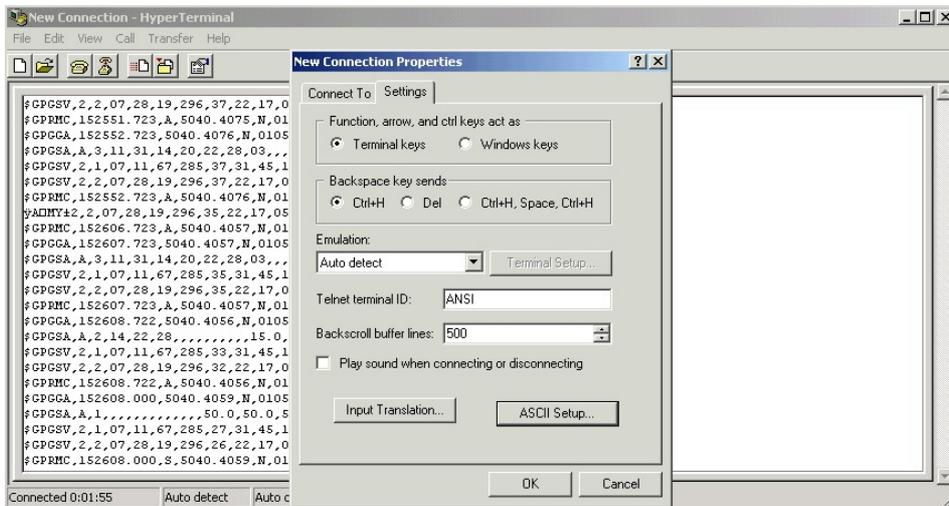


Figure 6: Settings of Connection Properties

On the appeared window select the check box with caption **send line ends with line feeds**.

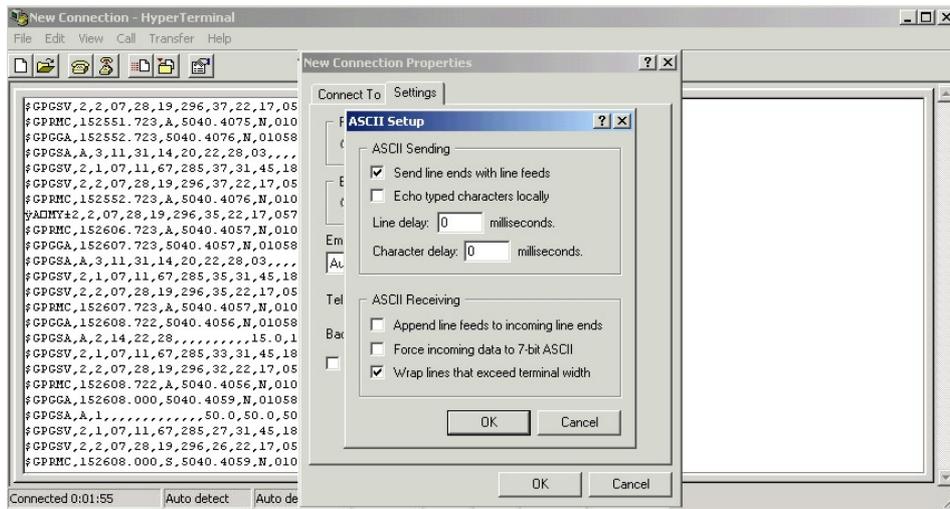


Figure 7: ASCII Setup

Next, open a text file and write the desired command (see Figure 8). Please note that after the command is written, the **enter** key needs to be pressed in order to complete the NMEA command (<CR><LF>), else the command will be ignored from the XT55 module. To save the active document to its current name and directory just open **File** menu and click **Save** item. Then close the current file.

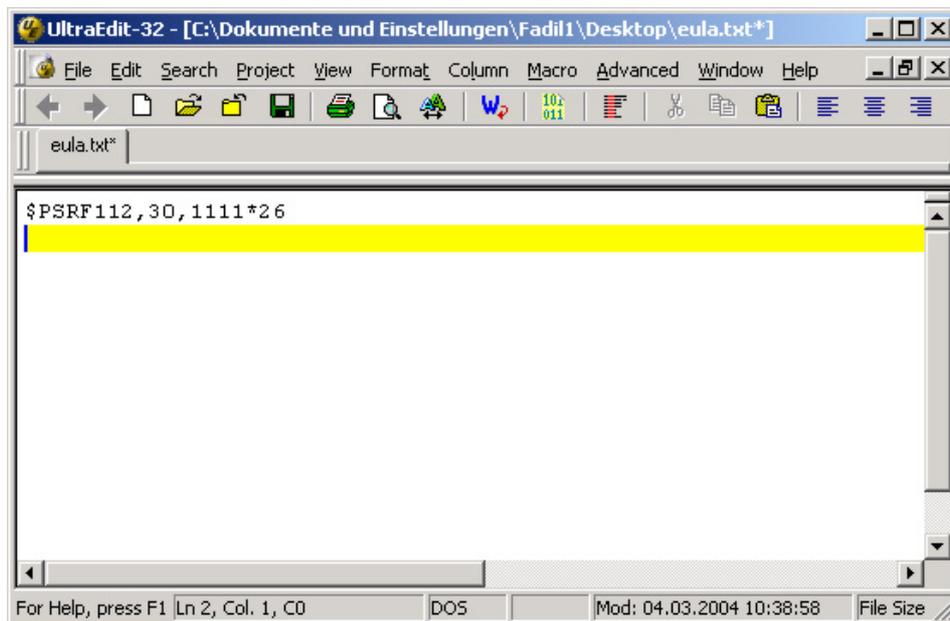


Figure 8: Example of an extended NMEA command

3 Tracking

3.1 History function

When receiving valid GPS protocols, the module XT55 is capable of saving up to 10,000 GPS protocols in its history memory.

When the memory space has been used up, the oldest protocols will automatically be deleted to make space for new incoming data.

Figure 11 shows a logical flow chart, for a better understanding how the module XT55 saves history data.

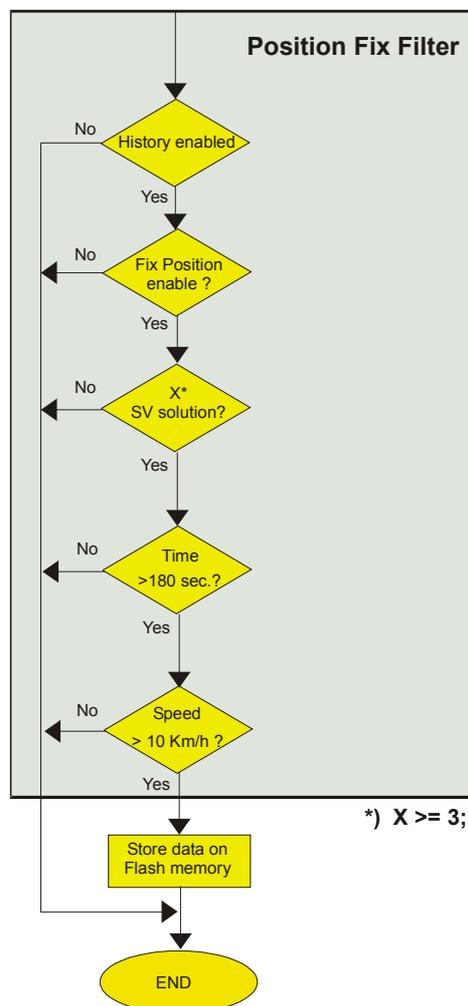


Figure 11: History Filter

3.1.1 Extended NMEA Commands – for XT55 only

3.1.1.1 Command Syntax

The XT55 module accepts NMEA commands in the following formats:

\$PSRF<command>,<parameter>, .. ,<parameter><* Checksum><CR> <LF>.

Command ¹	Parameter ²	Checksum ³	End Sequence
\$PSRF11	Data	*CKSUM	<CR> <LF>

¹ NMEA command

² valid parameters

³ the checksum consists of a "*" followed by two hex values. In order to calculate the Checksum, use your own application, which calculates the Checksum. Below a small source code is written in Visual Basic:

```
Public Sub CheckSum(field As String)
    If field = "" then
        CS = "*"
        CS = 0
        For i = 1 to Len(field)
            CS = CS Xor Asc(Mid$(field, i, 1))
        Next
        CS = Hex(CS)
        If Len(CS) = 1 then
            CS = "0" & CS
        CS = "*" & CS
    END SUB
```

Therefore, the string over which the checksum has to be calculated is (see example below):
field = PSRF112,21 //without the character "\$"

Example:

\$PSRF112,21*0A

Command	Parameter	Checksum	End Sequence
\$PSRF112,	21	*0A	<CR> <LF>

3.1.1.2 Extended NMEA command description

Please note that, all extended NMEA commands beginning with **\$PSRF111** are for internally test only. Whereas all extended NMEA commands beginning with **\$PSRF112** are implemented for configuration of history, alarm and remote tracking function. Please note that all NMEA commands, which have to be sent to the module XT55, are accepted when the **End Sequence** <CR><LF> is also included.

Commands	Description
\$PSRF112, value, *XX	<p>Parameter description:</p> <p>value: //commands overview Defined value 0 //overview of all implemented history, alarm and remote tracking commands</p> <p>*XX //Checksum has to be calculated.</p> <p>Example 1 \$PSRF112,0*39</p>
Commands build in remote tracking function	
\$PSRF112, value, Flag, phone_number *XX	<p>Parameter description:</p> <p>value: //configure the remote tracking Defined values 20 //enables remote tracking for authorized phone number 21 //enables remote tracking for any mobile phone 22 //disables remote tracking and empty the list of authorized phone number(s) 23 //displays the authorized phone number for remote access.</p> <p>Flag: //enter the position of authorized telephone numbers into the list (0..9 available). Overwrites the existing phone number.</p> <p>Phone_number: //enter the authorized phone number for remote access (optional). Please note: Once at least one number has been entered into the list, only these numbers are authorized to interact with the module XT55. All other accesses are ignored.</p> <p>*XX //Checksum has to be calculated.</p> <p>Example 1 \$PSRF112,20,2,012345678*01 This command enters (overwrites) in the list a phone number that is authorized for remote access to the module XT55.</p> <p>Example 2 \$PSRF112,21*0A This command deletes all existing entries (phone numbers) in the list, so it is possible to have remote access from any GSM modem or mobile phone.</p>

Example 3

\$PSRF112,22*09

This command deletes all existing entries (phone numbers) in the list and disables the remote tracking function.

Example 4

\$PSRF112,23,2*16

This command displays the telephone number which is listed in the given position.
Responds: phone number 2: 012345678

Enable the GSM functionality

\$PSRF112,
30,
PIN
*XX

Parameter description:

30: //enable the GSM functionality (i.e. deactivate PIN request)

PIN: //enter the PIN number of SIM card

*XX //Checksum has to be calculated.

Example 1:

\$PSRF112,30,1111*26

This command enters the PIN number of SIM card also deactivate the PIN request of SIM card.

Commands build in the history function

\$PSRF112,
rawData,
value,
*XX

Parameter description:

rawData: //configure the data format

Defined values

0 //request history in the NMEA format

1 //request history in the binary format

value: //configure the history download procedure

*XX //Checksum has to be calculated.

Example 1:

\$PSRF112,3,0*26

This command configures the module XT55 to send (upload) stored GPS history either from a directly connected module XT55 or from one communicating via a data connection in the NMEA format.

Example 2:

\$PSRF112,3,1*27

This command configures the module XT55 to send (upload) stored GPS history either from a directly connected module XT55 or from one communicating via a data line in the binary format.

<p>\$PSRF112, value, *XX</p>	<p>Parameter description: value: //configure history function Defined values 1 //enables history 2 //disables history *XX //Checksum has to be calculated. Example 1: \$PSRF112,1*38 This command enables the history function. The module XT55 records every 180 seconds if the vehicle is driving faster than 10 km/h. The settings 180 sec. and 10km/h are predefined parameters. Example 2: \$PSRF112,2*3B This command disables the history function. No data will be saved in the history.</p>
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Commands build in the alarm function

<p>\$PSRF112, value, key_number, phone_number *XX</p>	<p>Parameter description: value: //configure the download procedure Defined values 10 //enables key configuration 11 //disables key configuration 12 //displays key number key_number //determine the alarm key (1,2 possible) phone_number //set the authorized telephone number *XX //Checksum has to be calculated. Example 1: \$PSRF112,10,2,012345678 *02 This command enables key configuration as well the predefined RMC protocol is send to the authorized telephone number (012345678) in case of an alarm on the key 2. Example 2: \$PSRF112,11,2*17 This command disables the key (2) configuration. Example 3: \$PSRF112,12,2*14 This command displays the settings of given key number (2). The received format is: \$alarm key (2): phone: 012345678, protocol: RMC</p>
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Command for internal test

<p>\$PSRF111, value, *XX</p>	<p>Parameter description: value: //commands overview Defined value 0 //overview of all implemented test commands *XX //Checksum has to be calculated. Example 1: \$PSRF111,0*3A</p>
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<p>\$PSRF111, value, *XX</p>	<p>Parameter description: value: //configure the download procedure Defined values 1 //reports the version number of software and hardware 3 //performs the test of Flash 30 //performs the test of debugging 4 //performs the test of serial port 5 //performs automatic test 50 //performs automatic test (Siemens pre-test) 7 //performs the test of GSM board continuity 70 //information about the malfunctional tracks 8 //performs the test of all GPIOs 80 //information about the malfunction of GPIOs 81 //reports the current state of each read GPIOs (endless loop) 9 //information about the current voltage of antenna. 90 //calibration points, calculated voltage and current. *XX //Checksum has to be calculated. Example 1: \$PSRF111,1*3B Responds: current version: SW:XT_GPS_220_V0.95 HW:XT_GPS_B2.2_rev01a Example 2: \$PSRF111,3*39 Responds: ERROR or SUCCESS Example 3: \$PSRF111,30*09 Responds: Information about the performed flash test Example 4: \$PSRF111,4*3E Responds: ERR-malfunction detected or OK-serial port 2 successfully tested Example 5: \$PSRF111,5*3F Responds: ERROR GPIO or SUCCESS ERROR COM2 ERROR GPIO COM2 Example 6: \$PSRF111,50*0F Responds: ERROR GPIO or SUCCESS ERROR COM2 ERROR GPIO COM2 Example 7: \$PSRF111,7*3D Responds: ERROR or SUCCESS. Example 8: \$PSRF111,70*0D Responds: Verbose information about malfunctional tracks Example 9: \$PSRF111,8*32 Responds: ERR-malfunction detected or OK-all GPIOs successfully tested Example 10: \$PSRF111,80*02 Responds: Verbose information about malfunctional GPIOs.</p>
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Example 11:

\$PSRF111,81*03

Responds: the current state of each read GPIO (endless loop).

Example 12:

\$PSRF111,9*33

Responds: Vrf:0x85A Is:0x86C //Hex value of antenna voltage and current.

Example 13:

\$PSRF111,90*03

Responds: calibration points and calculated voltage and current.

Received alarm SMS from XT55

Protocol<CRLF>

Protocol

The following protocol type can be received: RMC

Example:

\$GPRMC,103530.000,A,5040.3986,N,01058.8636,E,0.06,171.45,290903,,*04<CRLF>

4 Software interface

The module XT55 is capable of outputting data in the NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard for Interfacing Marine Electronic Devices, Version 2.20, January 1st, 1997.

4.1 NMEA output messages

The table below shows all NMEA output messages supported by the module XT55 as well as a brief description of each output message.

Option	Description
GGA	Time, position and fix type data.
GLL	Latitude, longitude, UTC time of position fix and status.
GSA	GPS receiver operating mode, satellites used in the position solution and DOP values.
GSV	The number of GPS satellites in view satellite ID numbers, elevation, azimuth and SNR values.
RMC	Time, date, position, course and speed data.
VTG	Course and speed information relative to the ground.