



# Operation Manual

## GSM modem iRZ TG43-485





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## 1. Introduction

### 1.1. About this Document

The operation manual is intended for skilled PC users and provides the description and operating procedure of the iRZ TG43-485 GSM modem.

### 1.2. Service Information

Document version		Issue Date	
1.1		01/02/2016	
Prepared by:	P. Malikova, V. Golovin	Checked by:	B. Makatrinskiy

### 1.3. Safety Precautions

Restrictions on the router use near other electronic devices:

- Power off the modem in medical centres and keep it away from medical equipment (cardiac pacemakers, hearing aids). Medical equipment may be susceptible to any form of radio interference. In such areas the modem can transmit signals that could interfere with this equipment.
- Power off the modem in an aircraft. Take measures against accidental activation;
- Power off the modem near gas stations, enterprises of chemical industry, in areas where blasting operations are in progress. The modem can interfere with operation of technical devices.
- At close range the modem can interfere with television and radioreceiver operation.

To ensure safe operation, follow the recommendations:

- Do not expose the modem to aggressive influences (high temperatures, corrosive chemicals, dust, water, etc.).
- Protect the modem from impacts, falls and excessive vibration.
- Do not attempt to disassemble or modify the modem. Such actions will void the warranty.

**Note:** Use the device in compliance with the operating instructions. Damages caused by improper use and storage of the device are not covered by the warranty.



## 2. Overview

### 2.1. Purpose

The iRZ TG43-485 GSM modem is an industrial GSM modem designed for data and text messages communication over cellular network. The built-in TCP/IP stack and open Java platform provides easy integration of the modem into multiple M2M solutions: mobile access to the Internet, telemetry, wireless data collection from sensors, remote viewing, management and alarm systems. All the software required for creation of Java applications is in open access.

The modem is fitted with watchdog timer that enables tracking its deadlock as well as restarting it. Also it is possible to restart modem at set periods of time. The modem is controlled via standard AT commands as well as some control commands of its own. The terminal is equipped with the LEDs to monitor link status and abnormal conditions.

### 2.2. Package Contents

The iRZ TG43-485 GSM modem package includes:

- iRZ TG43-485 modem;
- original package.

### 2.3. Specifications

General characteristics:

- Frequency bands: GSM 850/900/1800/1900 MHz
- Output power:
  - 2 W (Class 4) for EGSM900;
  - 2 W (Class 4) for EGSM900;
  - 1 W (Class 1) for GSM1800;
  - 1 W (Class 1) for GSM1800;
- GPRS Class 12;
- TCP/IP stack, available via AT commands;
- MS Class B;
- CSD up to 9.6 kbps;
- USSD;
- SMS;
- open platform for developing Java applications;
- integrated PSU.



Parameters of open programming platform:

- Java™ ME 3.2;
- Memory: 5 MB (RAM), 10 MB (Flash);
- Secure data transmission with HTTPS and PKI support;
- Multitasking and multithreading, running several applets at once.

Power supply from external DC block

- Power voltage – 9 to 30V;
- Current consumption – not exceeding:
  - at power voltage of +12 V – 400 mA;
  - at power voltage of +24 V – 200 mA.

Power supply from internal AC block

- Power supply voltage 100 to 240 V;
- Current consumption – max 300 mA;
- Input voltage frequency – 50/60 Hz;
- The TG6-6P6C modular plug and terminal connector output voltage – 12V +/- 5%.

Physical Specifications

- Dimensions – max 90x54x59 mm;
- Weight: max 115 grams;
- Operating temperature: -20°C to +65°C;
- Storage temperature: -40°C to +85°C.

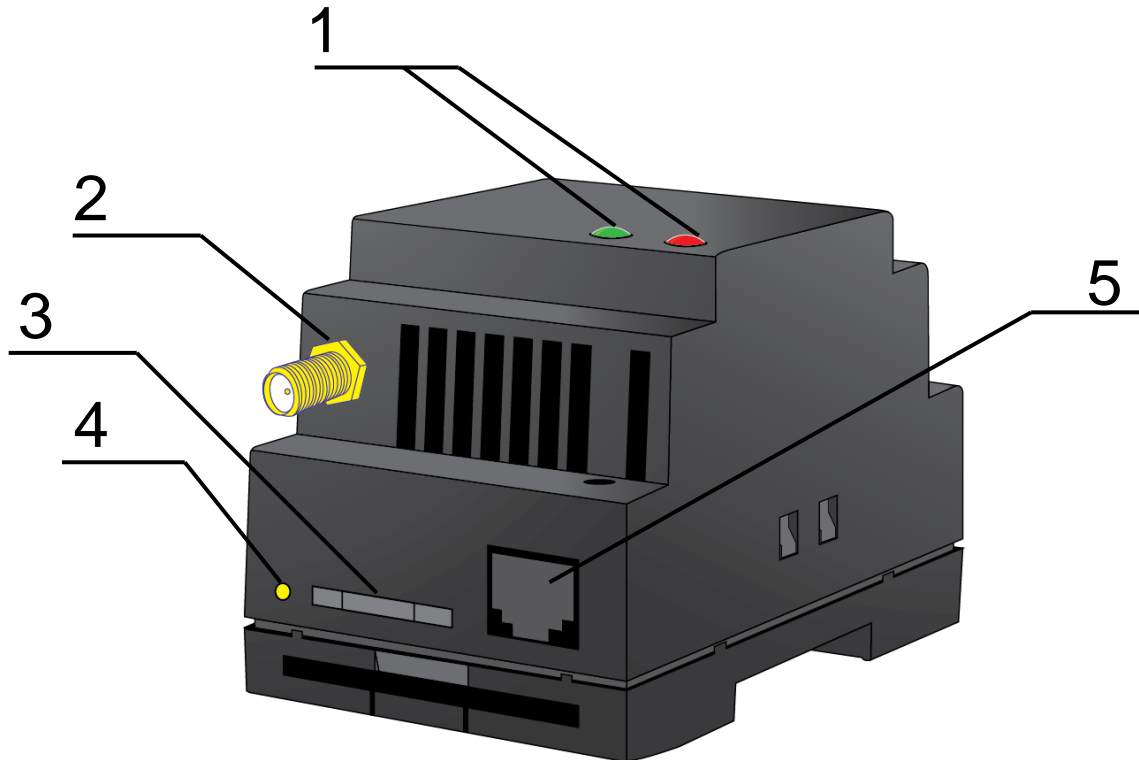
Interfaces:

- TJ6-6P6C (RJ12) power connector – the modem power supply, 3 digital inputs/outputs, 1 ADC channel.
- terminal connector – connection of communication cable (RS485), AC 220V modem power supply; DC 9-30V modem power supply;
- SMA antenna connector – connection of the GSM antenna.

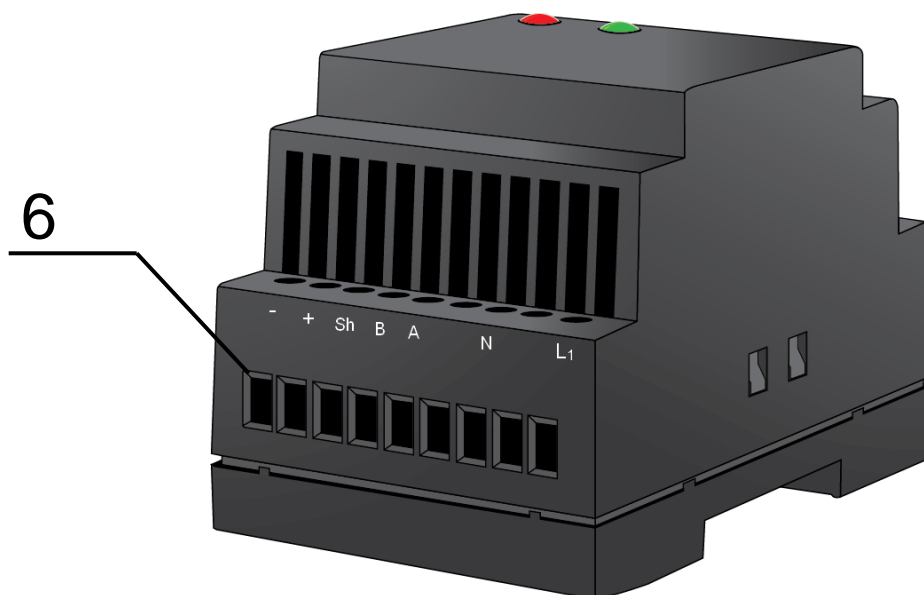


## 2.4. Device View

The iRZ TG43-485 modem is a compact-size device encased in a plastic housing. The device view is given in Fig. 2.1 and Fig. 2.2:



**Fig. 2.1** iRZ TG43-485 modem – front view



**Fig. 2.2** iRZ TG43-485 modem – back view



The numbers in the figures illustrate:

1. LED indicators – failure (red on the right) and network (green on the left);
2. SMA-F antenna connector – GSM antenna connection;
3. SIM card tray;
4. Eject button for SIM card tray;
5. TJ6-6P6C power supply connector;
6. Strip connector, RS485 communication cable connection and power.





## 2.5. Interfaces

### 2.5.1. Terminal Strip Connector

The connector is used for connection to a control device, RS485 serial communications and power connection. The modem is controlled via AT commands (see the command description on the module).

Factory settings: speed 115200 bit/s, data bit – 8, parity – no, stop bit – 1.

The view of the connector is shown in Fig. 2.3.

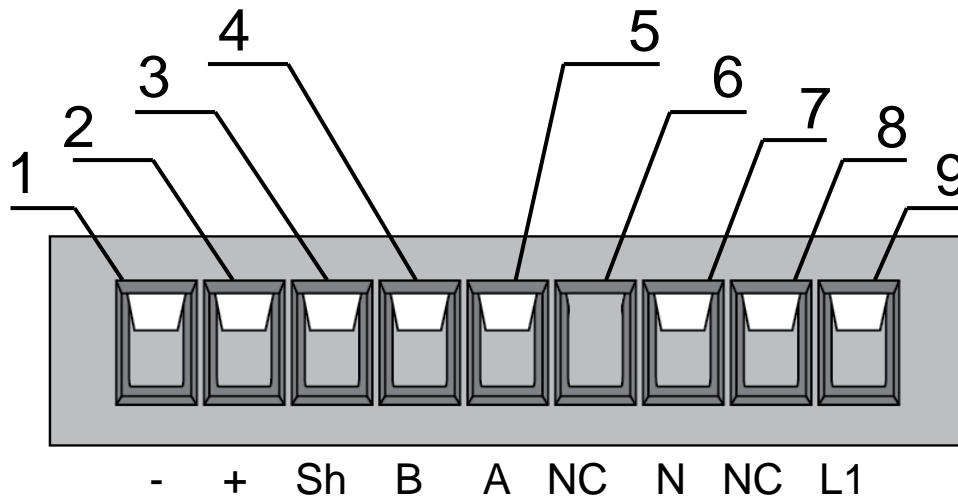


Fig. 2.3 Plug terminal connector

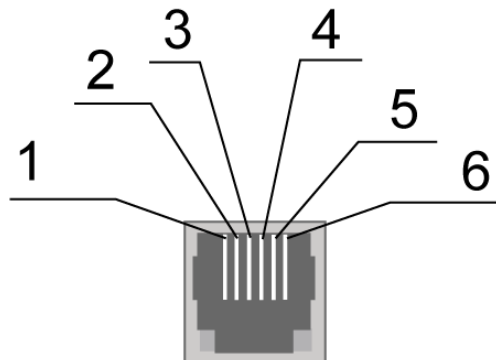
Table 2.1 Terminal strip connector pin assignments

Strips	Signal	Function	
1	-	DC 9-30V modem power supply, if powered from AC 200V – output 12V (max 100mA), "-" terminal	
2	+	DC 9-30V modem power supply, if powered from AC 200V – output 12V (max 100mA), "+" terminal	
3	Sh	"Display" RS485	
4	"B"	"d-" RS485; inverted differential input	Interface's lines are protected by polyfuse and burst interference cancel circuit as well as surge voltage protector.
5	"A"	"d+" RS485; noninverted differential input	
6	NC	Not used	
7	N	Power ~220V, 50Hz	
8	NC	Not used	
9	L1	Power ~220V, 50Hz	

**Note:** When receiving/transmitting data via interface note that the RS485 interface is half-duplex. When echo is enabled, data sent to the modem is transmitted back, that might produce collision. It is required to disable echo (**ate0** AT command) to eliminate this problem.



## 2.5.2. Power Connector



**Fig. 2.4** Power Connector

**Table 2.2** Power connector pin assignments

Pin	Signal	Function
1	+ 12V	DC 9-30V modem power supply, if powered from AC 200V – output 12V (max 100mA), "+" terminal
2	GPIO4	Digital input/output
3	GPIO6	Digital input/output
4	ADC	Analog-to-digital converter
5	GPIO7	Digital input/output
6	GND	System Housing

**Note!** Total current at TJ6-6P6C and connector's pins №1 and №2 must not exceed 100 mA.



## 2.6. Modem Status Indicators

Two LED indicators are used for displaying operation mode status or emergency situation. This function is configured via AT command AT^SLED ((AT^SLED=2,50 — on; AT^SLED =0 — off). AT^SLED is an energy-dependent parameter; upon modem activation AT^SLED =0.

Table 2.3 provides information on LED indicators of AT^SSYNC=1 configuration.

**Table 2.3** Operation mode indication (green LED)

Status display mode	Schematic LED signals representation	Operating mode
Off	○	The modem is switched off or at fault condition; power-saving mode; "ALARM" mode
500 ms on / 500 ms off	●●●●●○○○○○	The modem is not registered to the network
50 ms on / 4 s off	●○○○○○○○○○...○	The modem is registered on the network
50 ms on / 2 s off	●○○○○...○	GPRS connection is established
50 ms on / 2 s off	●○○○○...○	Transmitting data (GRPS)
250 ms on / 250 ms off	●●●○○○	Programming mode, menu mode
50 ms on / 1 s off	●○...○	Voice call, CSD

**Table 2.4** Fault condition indication (red LED)

Status display mode	Schematic LED signals representation	Fault description
Continuously lit	●	Wrong input voltage
0.5 s on / 0.5 s off	●●○○	Wrong module power
0,25 s on / 0,25 s off / 0,25 s on / 1 s off	●○●○○○	GSM module not launched

Emergency situations are described in section 6 of this document.



### 3. Functional Diagram and Operation Description

#### 3.1. Functional Diagram

Functional diagram is presented in Fig. 3.1:

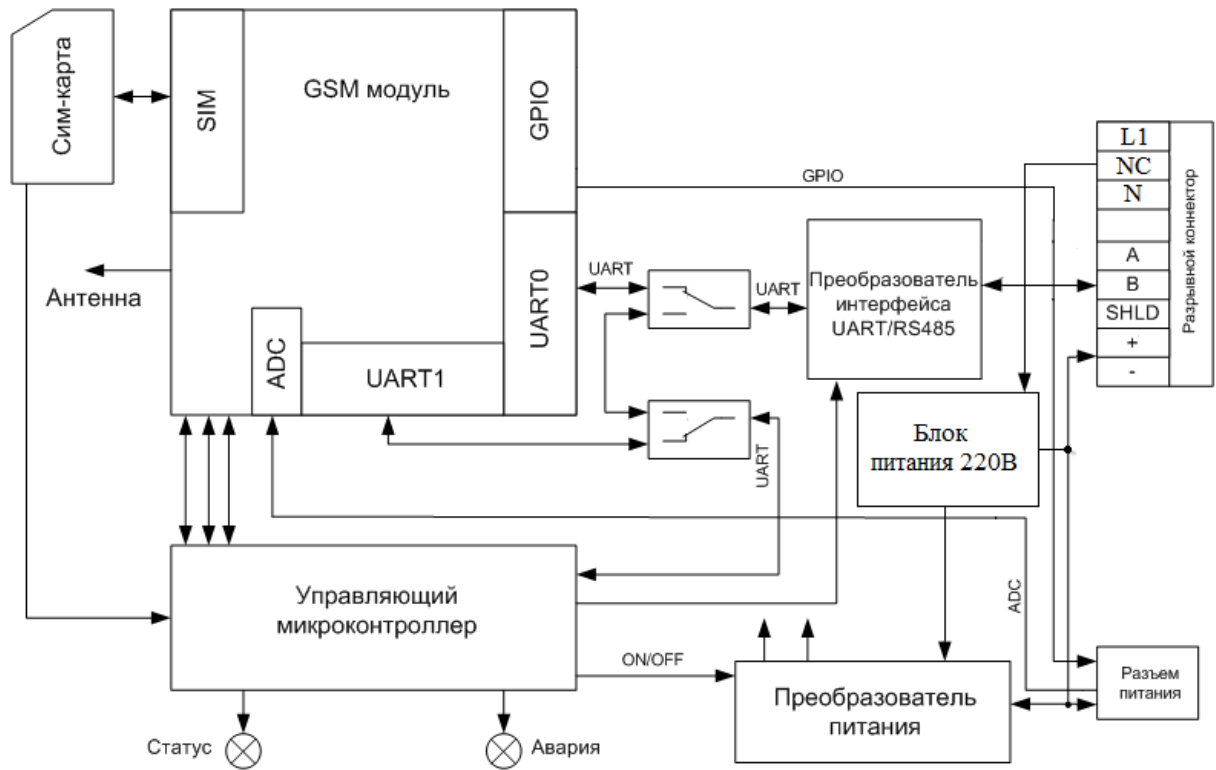


Fig. 3.1 Modem's functional diagram



### 3.2. Operation Description

Modem operation mode is determined by position of a SIM tray. If the SIM tray is inserted, the modem runs in operation mode: RS485 terminal connector's interface pins are commutated to UART0 of GSM module; UART of managing microcontroller is connected to UART1 of GSM module; GSM module is on.

If the SIM tray is ejected, the modem will re-enter Menu mode (SIM tray is ejected after modem was powered up). GSM modem is off (power on module is off), RS485 terminal connector's interface pins are commutated to UART of managing microcontroller.

Menu mode's function is to configure modem parameters and access statistics.

Modem can be powered from any of the 2 connectors: power connector or terminal connector.

### 3.3. Types of Watchdog Timers

GSM modem is fitted with several types of watchdog timers.

- Managing microcontroller-integrated watchdog timer. Checking MC's software for hang up (Cannot be disabled);
- Periodic check of GSM module (Java application) hang-up by managing microcontroller. Its operation principle is as follows: managing microcontroller periodically sends "at" command (speed 115200, 8-N-1) to a second COM port of GSM module (UART1) and awaits response: "at", then "OK". Each command should be followed by \r=CR \n=LF. It means that a response should be similar to a response of a module with enabled echo, without the Java application. Response wait time is 100ms. If no response was received, the request is repeated. In total, 5 requests are made. If all attempts fail, GSM module is restarted; module's power is switched off. Periodic check interval can be set for 1 minute to 255 minutes with 1 minute step. Use Menu mode to enable/disable this function or to set the interval. This function is disabled by default. Note: Java application may use this COM port, which will lead to continuous module resetting if the function is enabled.
- Modem is reset unconditionally at the set intervals. This function is disabled by default. Interval can be set for 1 to 255 hours with 1 hour step. Its operation principle is as follows: the managing microcontroller resets the GSM module at set periods of time; module's power is switched off. The function is controlled via the Menu mode.



## 4. Connection and Configuration

### 4.1. Connection

All installation operations are to be carried out by a qualified specialist familiar with the installation guide.

Before supplying power, install the SIM card into the modem. SIM card installation and removing is to be carried out only when the device is powered off. To install SIM card, follow the steps:

- remove the SIM tray pressing the SIM tray eject button (see Fig. 2.1);
- insert a SIM card into the SIM card tray;
- insert the SIM card tray into the modem.

Do not apply much force when inserting a SIM card.

Connect a GSM antenna and a switching cable (RS485). Turn the modem's power supply on via power connector or disruptive connector (see Fig. 2.2). After the modem has been powered, it will start. It will be indicated with frequent flashing of green LED (see Table 2.3). If PIN code is switched off, registration within network will occur automatically. As soon as the registration is complete the modem switches to an operation mode, the indicator blinks less frequently.

**Note:** A GSM antenna, switching cables and a power supply unit are not included.



## 4.2. Control, Reset and Power Off

The modem is controlled using standard AT commands as well as a set of original commands (see GSM module AT commands description). Additional information can be found on the websites [www.radiofid.ru](http://www.radiofid.ru) and [www.irz.net](http://www.irz.net).

You can reboot the modem in the following ways:

- Reboot after a set period of time (WD interval, switched off by default). Configured in the Menu mode;
- by AT command “AT+CFUN=1,1”;
- by temporary powering off.

You can turn off the modem in the following ways:

- by powering off;
- by AT command “AT^SMSO”.

Switching to power saving mode is done with AT command “AT+CFUN”. For more detailed information, see description of AT commands for GSM module.



### 4.3. Menu mode

Menu mode's function is to change the modem parameters and access statistics. In Menu mode, GSM module's power is switched off; it automatically switches on after exiting Menu mode. Switching to Menu mode is possible from Operation mode. To switch to Menu mode, eject the SIM tray. Before accessing the menu mode connect the modem to the computer (speed: 115200 bit/sec, 8-N-1), run Hyper Terminal or a similar program to communicate with the modem.

The modem will go into the menu mode:

Menu mode:

Variant XX

<P1> View statistics

<P2> WD interval=OFF

<P3> 'AT' control=OFF

<PC> Power control

<PR> Clear statistic

<PS> Change speed: auto

**Variant XX** – firmware version.

The <P...> characters indicate the control commands. To run a command, press the **Enter** key. If the command is incorrect, the ERROR message is displayed. The command input is case-insensitive.

“**P1**” command will switch to statistics mode:

Statistics:

Power\_Modem = XX...X

Bad\_Power\_Modem = XX...X

Power\_Module = XX...X

Bad\_Power\_Module = XX...X

Start\_Module = XX...X

Bad\_Start\_Module = XX...X

Deadlock\_of\_Module = XX...X

Reset = XX...X





When using the modem, the following events are automatically saved.

**Power\_Modem** – the number of the modem actuations;

**Bad\_Power\_Modem** – the number of power deviations of the modem;

**Power\_Module** – the number of power supplies applied to the GSM module;

**Bad\_Power\_Module** – the number of power deviations of the GSM module;

**Start\_Module** – the number of successful starts of the GSM module;

**Bad\_Start\_Module** – the number of failed starts of the GSM module;

**Deadlock\_of\_Module** – the number of GSM module deadlocks;

**Reset** – the number of reboots.

After displaying statistics, the modem will switch to Main Menu

“P2” command will switch to WD mode:

WD interval, hour (0 – WD off, max – 255)

<Q> Quit

WD interval=

This sets the time interval for module restart. For changing this interval, enter number from 0 to 255 and press "Enter" key. Interval is set in hours. To disable this function enter 0. Please note, that the modem will be forced to restart after interval expiration. If entry is incorrect, "ERROR" message will be displayed and you will be redirected to WD menu again. If entry is correct or after entering “Q” command, you will be redirected to Main menu.

Command “P3” switches to AT submenu.

'AT' control, minutes (0 – off, max – 255)

<Q> Quit

control=

This submenu sets interval of checking module deadlock by managing microcontroller. For changing this interval, enter number from 0 to 255 and press "Enter". Interval is set in minutes. To disable this function enter 0. If entry is incorrect, "ERROR" message will be displayed and you will be redirected to AT submenu again. If entry is correct or after entering <Q> command, you will be redirected to Main menu.

**Note:** If using of Over The Air Provisioning (OTAP) operation is intended, then the interval for periodic checks should be exceeding the time required for loading a new Java application. Generally, the process takes no longer than 10 minutes.

Entering the “PC” command allows to review the input voltage and the voltage of the module (measurement precision 5%):

POWER Uin=12.0 Umd=3.9



After displaying data, the modem will switch to Main Menu

“**PR**” command will switch to statistics reset menu:

Clear statistic?

<YES> YES

<Q> Quit

Reset the accumulated statistics by <**YES**> command. If entry is incorrect, "ERROR" message will be displayed and you will be redirected to WD menu again. If entry is correct or after entering <**Q**> command, you will be redirected to Main menu.

“**PS**” command will enter menu of determining data transmission speed. Modem is always set to receive data. A switch to transition occurs when data to be transmitted appears. Setting a fixed speed of data transmission eliminates errors in calculating the interval of transmission switch. This allows minimizing pauses between transmission and reception of data. More importantly, it eliminates the possibility of losing the data at the beginning of the transmission. By default, the modem is set to automatically detect speed of data transmission.

Menu speed:

<0> auto

<1> 115200

<2> 57600

<3> 38400

<4> 28800

<5> 19200

<6> 14400

<7> 9600

<8> 4800

<9> 2400

<10> 1200

<11> 600

<12> 300

<Q> Quit

For changing the speed, enter number from 1 to 12 and press "Enter" key. To disable this function enter 0. If entry is incorrect, "ERROR" message will be displayed and you will be redirected to WD menu again. If entry is correct or after entering <**Q**> command, you will be redirected to Main menu.

Entering “**M**” command switches to back Main menu.

The exit from Menu mode occurs after inserting SIM tray



## 5. Creating, Installing and Removing Java Based Applications

This modem is built on BGS5 module with integrated Java platform, which allows performing numerous tasks. You can create, install and delete Java applications via special tool "Module Exchange Suite" (MES) by Cinterion Company. This software can be found on our website [www.radiofid.ru](http://www.radiofid.ru). Alternatively you can order Software CD from our managers.

After installing "Module Exchange Suite", new disk named "Module" should appear on your PC.

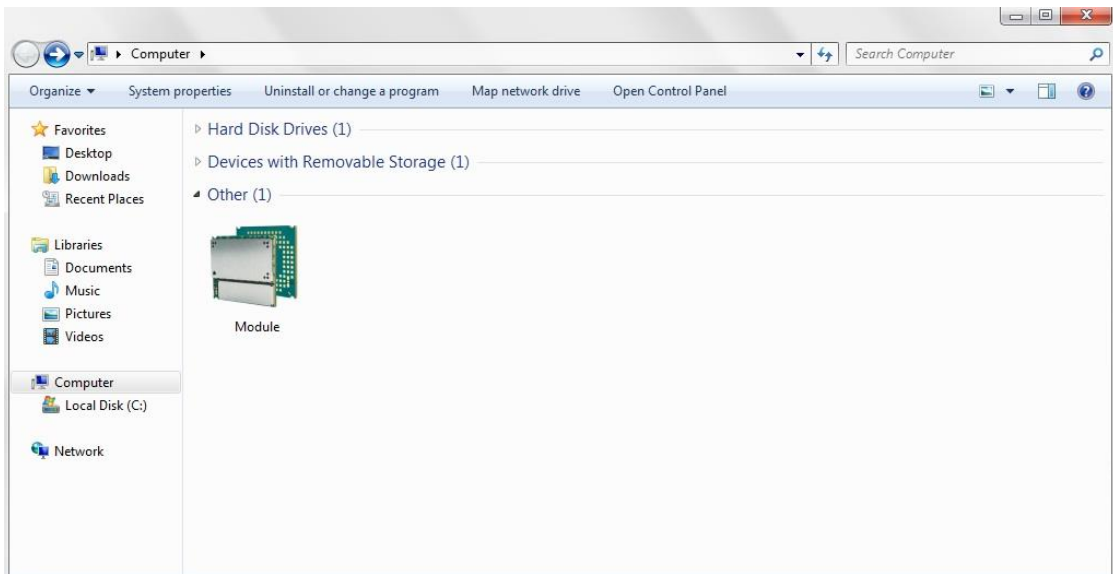


Fig. 5.1 My Computer Window in Windows 7

In Disk properties ("Port" tab) select COM-port to which the modem is connected.

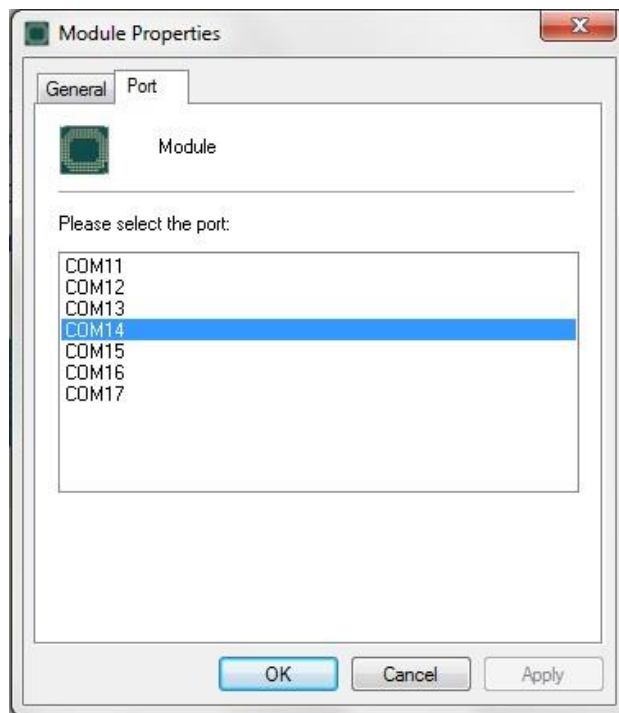


Fig. 5.2 Selecting the Required COM Port



"Module Exchange Suite" writes and deletes files from "Module" disk. For example, to install Java application, just copy program's files to "Module" disk and send AT command `AT^SJAM=0,"a:/HelloUniverse.jad",""`.

Java application's autostart is set using the following AT commands:

- `AT^SCFG="userware/autostart/delay", "", "100"` (autostart initiates in 10 seconds after module was switched on);
- `AT^SCFG="userware/autostart", "", "1"` (autostart enabled).
- `AT^SCFG=0,"a:/HelloUniverse.jad", ""` – (install application into module's memory). Also you need to add the following lines into the .jad file:
  - Oracle-MIDlet-Autostart: n (numerical number of midlet at launch, its value range is 0..5 "0" indicates that autostart is disabled)
  - Oracle-MIDlet-Restart: true (restart the midlet in case of incorrect termination).
  - Oracle-MIDlet-Restart-Count: m (figure representing number of times the application may be restarted before restarting the module).

It is recommended to set autostart interval to ~10 seconds. It is especially important when testing new Java applications, since it simplifies the procedure of autostart disabling. After Java application autostart, port(s) may not react to AT commands.

For deleting Java application disable its autostart by via `AT^SJAM=2,"a:/HelloUniverse.jad", ""` AT command. It requires a sufficient autostart interval set in advance, or having a port that responds to AT commands available and not used by running Java applications. It is recommended to send this AT command after 2-5 seconds after powering up the modem. If there is a port not used by running Java applications, AT command may be sent at any moment. After AT command was successfully sent, modem gives a reply: "OK". Now you should send command `AT^SJAM=3,"a:/HelloUniverse.jad", ""` – delete application. Note that .jar and .jad files will not be deleted from internal memory – you can delete them manually via MES.

Deleting Java applications means deleting files on "Module" disk. Also, there is an option to remotely update Java application – "Over The Air Provisioning" (OTAP). For more detailed information, address documentation on Development Software CD.



## 6. Emergencies

To facilitate the use of the modem, tracking and display of emergencies are provided.

### 6.1. Emergency 1 (incorrect input power supply)

Emergency 1 occurs when the input power supply deviates from the permissible value. The modem stops operating and switches off GSM module power supply. Red LED signal is continuously lit to indicate emergency. The recovery is possible only when the input power supply is re-established.

### 6.2. Alarm 2 (incorrect module power supply)

Emergency 2 occurs when GSM module's power supply deviates from the permissible value. The modem stops operating. A red LED signals that the emergency has occurred (0.5s on / 0.5s off). The recovery is possible only if the module power supply is re-established within 10 seconds after the emergency occurred. If within 10 seconds the module power supply remains incorrect (with a correct input power supply), the modem goes into the waiting mode meaning that the modem's power supply is turned off, the emergency indication is preserved. The waiting mode can be terminated only after the power is completely disconnected.

In case of repeated emergency, the modem should be serviced.

### 6.3. Emergency 3 (GSM module failed to run)

Emergency 3 occurs if the GSM module does not turn on or is absent. A red LED signal (0.25s on / 0.25s off / 0.25s on / 1s off) turns on after the modem precisely detects the emergency situation (~15 sec). The recovery is possible only after a successful launch of the GSM module. After 10 unsuccessful attempts to launch the module, the modem goes into the waiting mode. The modem's power supply is turned off, the emergency indication is preserved. The waiting mode can be terminated only after the power is completely disconnected.

In case of repeated emergency, the modem should be serviced.



## 7. Support

To get updated documents and software updates, please use the following contacts:

<b>St. Petersburg</b>	
The company's website:	<a href="http://www.radiofid.ru">www.radiofid.ru</a>
Phone number in St. Petersburg:	+7 (812) 318 18 19
E-mail:	<a href="mailto:support@radiofid.ru">support@radiofid.ru</a>
<b>Moscow</b>	
The company's website:	<a href="http://www.digitalangel.ru">www.digitalangel.ru</a>
Phone number in Moscow:	+7 (495) 974 74 22
E-mail:	<a href="mailto:info@digitalangel.ru">info@digitalangel.ru</a>

Our specialists are always ready to answer your questions, assist in installation, configuration and resolve difficulties with using the equipment.