

 **USER GUIDE**  
**GSM modem**  
**iRZ TC65 Lite**





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## 1. Introduction

### 1.1. Document description

This document is intended for experienced PC users and describes the hardware of the iRZ TC65 LITE modem and the order of operation with it.

### 1.2. Service information

Document version		Issue date	
2.1		09.19.2013	
Prepared by	V.N. Golovin	Approved by	P.A. Kosolapov

### 1.3. Safety restrictions

Restrictions on the use of the device near other electronic devices:

- Turn the modem off in hospitals or when located near medical equipment such as pacemakers, hearing aids and so on. Interference for medical equipment may occur
- Turn the terminal off when on an airplane. Take measures to avoid accidental turning on
- Turn the modem off in the vicinity of gas stations, chemical plants, and places where demolition work is conducted. Interference for technical devices may occur
- At a close range, the modem may produce interference for television sets and radio transmitters

Maintenance requirements:

- Protect the modem against external hazards (high temperatures, caustic chemicals, dust, water and so on)
- Keep the modem safe from blows, falls, and strong vibrations
- Do not attempt to take apart or modify the modem on your own. Such actions will void your warranty

**Note:** Make sure you follow the operation manual for this device. Improper use of the device will disqualify your warranty.



## 2. General Information

### 2.1. Purpose

The GSM modem iRZ TC65 Lite is an industrial GSM modem designed for reception and transmission of data via the GSM channel (GPRS class 12). Due to the embedded TCP/IP suit, and the support of the open Java platform, in is easily integrated in many M2M solutions: mobile Internet access, telemetry, wireless data collection from sensors, remote viewing, control and signaling.

The control is performed by means of standard AT-commands. The terminal is equipped with a LED indicator to track the connection status.

### 2.2. Configuration

Complete set of the GSM modem iRZ TC65 Lite:

- terminal iRZ TC65 Lite;
- factory box;

### 2.3. Parameters

Basic parameters:

- frequency ranges: GSM 850/900/1800/1900 MHz;
- power output:
  - 2W (class 4 for EGSM850/900);
  - 1W (class 1 for GSM1800/1900);
- GPRS class 12;
- TCP/IP stack, available through AT-commands;
- MS class B;
- CSD up to 14.4 kbps;
- USSD;
- SMS: MT, MO, CB, Text and PDU podes;
- fax group 3: class 1

Parameters of the open software platform:

- processor ARM7;
- memory: 400 Kb (RAM), 1.7 Mb (Flash);
- economy power supply mode;
- control of TCP/IP stacks by means of AT commands



Java™ parameters:

- CLDC 1.1 HI;
- J2ME™ with IMP 2.0 support;
- Secure data transmission with HTTPS and PKI support;
- TCP, UDP, HTTP, FTP, SMTP, POP3 support;
- remote update of applications (OTAP)

Electric power supply:

- power supply voltage 9 to 30 V;
- absorbed current:
  - with power supply voltage +12 V – 400mA;
  - with power supply voltage +24 V – 200mA

Physical parameters:

- size, max 70x74x33 mm;
- weight, max 100 g.;
- operating-temperature range -30°C to +65°C;
- storage temperature range -40°C to +75°C;

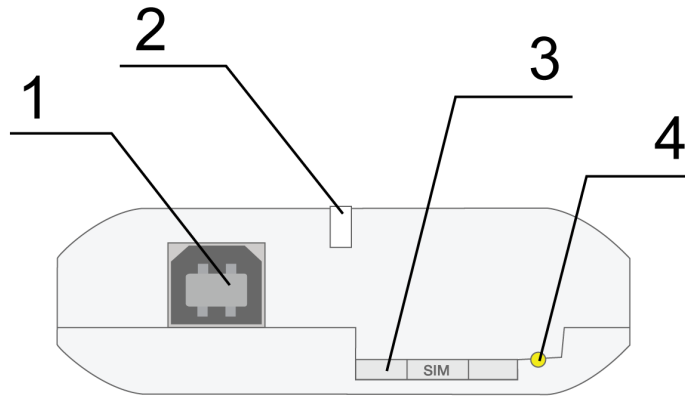
Interfaces:

- Connector DB9 RS232;
- Connector USB-B USB 2.0;
- FME antenna jack;
- Connector TJ6-6P6C for power supply (power supply, GPIO, ADC)

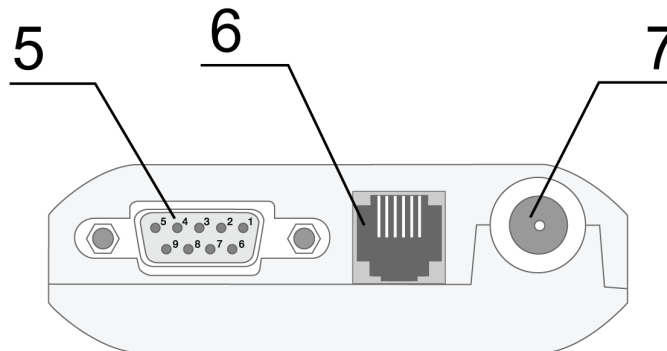


## 2.4. Exterior appearance

The modem TC65 Lite is a compact device designed in lightweight plastic housing. The exterior appearance is represented on Fig. 2.1 and Fig. 2.2:



**Fig. 2.1.** Front view



**Fig. 2.2.** Back view

On the figures 2.1 and 2.2 the digits signify the following:

1. USB connector type B for data cable connection;
2. LED indicator of status (green) and emergency (red);
3. SIM card tray;
4. SIM card tray extractor;
5. DB9 (RS232) connector for data cable connection;
6. TJ6-6P6C connector for power supply connection;
7. FME connector for GSM antenna connection



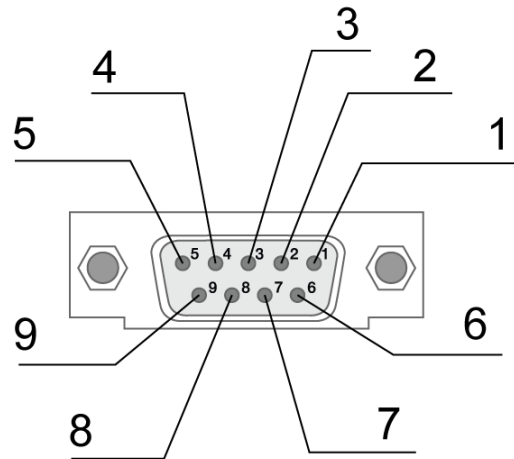
## 2.5. Interfaces

### 2.5.1. Connector DB9 for data cable connection

This connector is used for connecting the modem to the control device using the RS232 exchange protocol.

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

The AT-commands are used to control the modem operation (see the module description). Please see the external look of the connector on Figure 2.3.



**Fig. 2.3.** Connector DB9

**Table 2.5.1:** Purpose of the connector DB9 pins

Contact	Signal	Direction	Purpose
1	DCD	Modem -> PC	Availability of carrier wave
2	RXD	Modem -> PC	Data reception
3	TXD	PC -> Modem	Data transmission
4	DTR	PC -> Modem	Availability of data reception
5	GND	general	Ground
6	DSR	Modem -> PC	Availability of data
7	RTS	PC -> Modem	Request for transmission
8	CTS	Modem -> PC	Availability of transmission
9	RI	Modem -> PC	Call signal

The purpose of pins is consistent with the serial interface to ITU-T V.24 Interchange Circuits DCE.

The length of the cable is not to exceed 1.8 m. It is recommended to set data transfer speed that does not exceed 115200 bit/s.

**Attention:** RS232 standard (COM-port) does not support a "hot" connection.

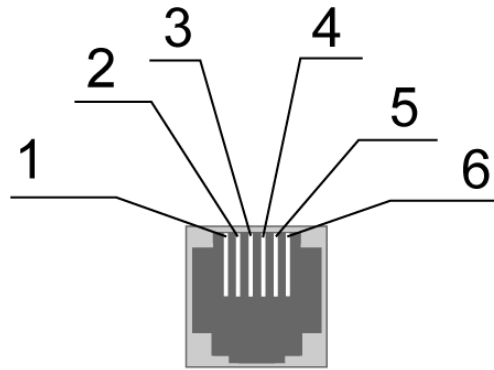
To avoid damaging the COM-port of the modem connect and disconnect the device at least 5 seconds after the power of the connecting devices has been turned off.





### 2.5.2. Power Connector TJ6-6P6C

The connector is used for connection of power. Purposes of the connector pins are described in table 2.4:



**Fig. 2.4.** Connector TJ6-6P6C

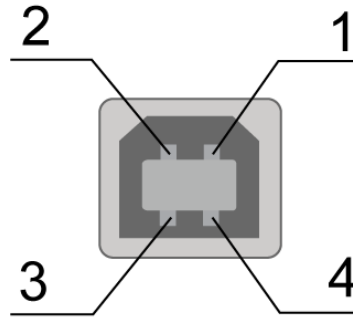
**Table 2.5.2:** Purpose of the connector TJ6-6P6C pins

Contact	Signal	Purpose
1	Vcc	Positive pole of DS supply voltage
2	GPIO4	Digital input-output, controlled by module's pin GPIO4. Parameters are similar to GPIO5.
3	ADC2	A/D converter. Parameters of the input circuit: input resistance 180 KOhm. Voltage divider 10:1. Connected to ADC2-output of GSM module. Range form 0 to 22 V.
4	ADC1	A/D converter. Parameters of the input circuit: input resistance 180 KOhm. Voltage divider 10:1. Contact is connected to ADC1-output of GSM module. Range form 0 to 22 V.
5	GPIO5	Digital input-output, controlled by module's pin GPIO5. Parameters: $V_{OLmax} = 0.2V, I = 2mA,$ $V_{OHmin} = 2.5V, I = -0.5mA,$ $V_{OHmax} = 3.0V,$ $V_{ILmax} = 0.8V,$ $V_{IHmin} = 2.2V,$ $V_{IHmax} = 3.0V$
6	GND	Ground



### 2.5.3. USB Connector

The connector is used to connect to the control device. The USB port does not have priority over the COM port (the COM port becomes deactivated).



**Fig. 2.5.** Connector USB

**Table 2.5.3:** Purpose of the USB connector pins

Contact	Signal	Purpose
1	V BUS	+5 V (is used as input to define the USB connection)
2	D-	Data transmission
3	D+	Data transmission
4	GND	System housing



## 2.6. Modem status indication

Two LEDs are used to indicate the operation mode or any emergency situation.

**Table 2.6.1:** Operation mode indication (green LED)

Indication mode		Operation mode
Turned off	○	Modem is turned off or there is an emergency situation
600 ms on / 600 ms off	●●●●●○○○○○	Modem is not registered in the network
75 ms on / 3 s off	●○○○○○○○○○...○	Modem is registered in the network
75 ms on / 75 ms off / 75 ms on / 3 s off	●●●○○○○○○○...○	GPRS/EDGE connection is installed
500 ms on / 50 ms off	●●●●●○	Data transmission is underway
250 ms on / 10 s off	●●●○○○○○○○...○	Modem is in power standby mode, alarm clock mode.
250 ms on / 250 ms off	●●●○○○	Programming mode, menu mode
Permanently turned on	●	Voice call, CSD

**Table 2.6.2:** Emergency mode indication (red LED)

Indication mode		Emergency description
Turned on continuously	●	Input voltage invalid
500 ms on / 500 ms off	●●○○	Power supply of the module invalid
250 ms on / 250 ms off / 250 ms on / 1 s off	●●○○○○	GSM module not started
250 ms on / 250 ms off / 250 ms on / 250 ms off / 250 ms on / 1 s off	●●●○○○○	COM port unavailable

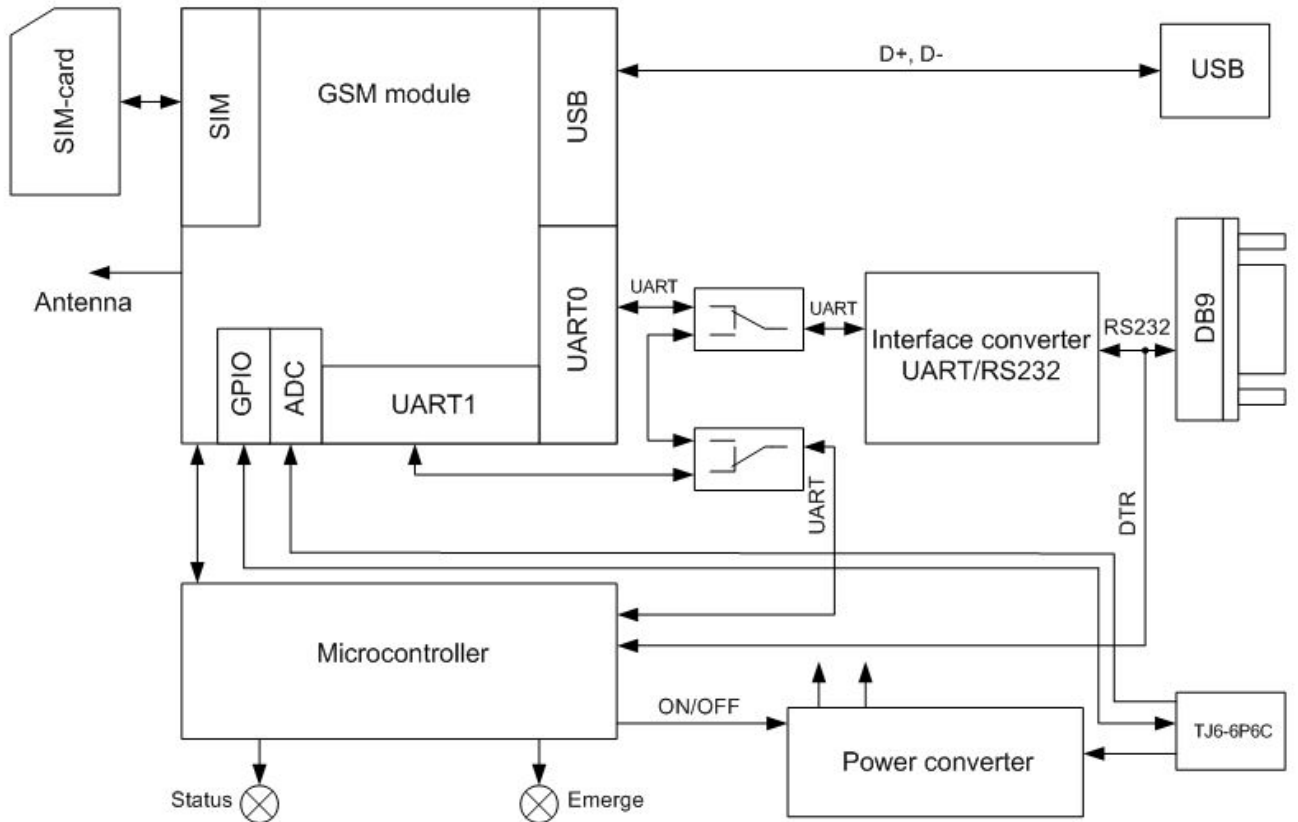
For description of emergencies see Section 4 (page 22)



### 3. Connection, Setting Up and Control

#### 3.1. Functional Diagram

The functional diagram of the modem is represented on Fig. 3.1:



**Fig. 3.1.** Functional diagramm



### 3.2. Connection, Operation Mode

The application field of the modem can be divided into two nominal parts: personal computer connection for Internet access and industrial use.

In both cases the connection sequence is the same.

Before feeding the power supply you need to install the SIM card in the modem (SIM card must be enabled). To do this, you need:

- to extract the SIM tray by pressing the SIM tray extract button (Fig. 2.1);
- to install the SIM card in the SIM tray;
- to insert the SIM tray into the modem.

No strong physical efforts must be applied while installing the SIM card.

Connect the GSM antenna and the commutation cable (RS232 or USB) to the antenna connector (Fig. 2.2). Thereupon you need to feed power supply to the modem through the connector TJ6-6P6C (Fig. 2.1).

**Note:** GSM antenna, the commuting cables and the power supply are not included in the set.

After the power supply feeding, the operating microcontroller analyses the availability of the SIM tray. With the SIM tray available, the modem jumps to the operation mode: checks the input voltage, commutates the UART0 pins of the GSM module to the external connector DB9, UART1 pins to the operating microcontroller, activates the GSM module. Then the registration proceeds, the "Status" LED flashes frequently. After the registration is completed, the indicator flashes less frequently (Table 2.6.1). In this mode the GSM module controls the flashing.



### 3.3. Control, Restarting and Power Off

The modem is controlled by standard AT commands.

The modem can be restarted in the following ways:

- by eight jumpings of the DTR line of the COM port into passive state (DTR < -2V), duration of pulses and the pauses between the pulses must lie within the range 100-500 ms;
- by issue of a control command by the GSM module via UART1 (time rate 115200 bps, 8-N-1) to the operating microcontroller (operation mode). The command format: @MRST[XX]<CR>, where [XX] is the number of minutes in hexadecimal representation (255 max), in which the module must be started – jumping to the operation mode. If [XX] = 0, it should not be started. If the command is accepted successfully, the response is “OK”, otherwise it is “ERROR”. The command is completed with the code <CR> ('\r' or 0x0D in hexadecimal representation). Installation of blockage or enabling for transition to the power standby mode in the menu mode does not affect this command's operation. During the issue of this command, the operating microcontroller is expecting for the module's deactivation (analysis of the PWR\_IND and VEXT pins) and starts it in a specified time period;
- by using the AT-command (“AT+CFUN=1,1”);
- by restarting in a specified time period (WD interval, disabled on default), setting up is carried out in the menu mode;
- by temporary power-off.

The modem can be disabled using the following ways:

- by program method, using the AT commands (transition to the power standby mode);
- power supply disconnection.

When disabled by AT commands, the modem jumps to the power standby mode (minimum consumption). Escaping from the power standby mode is made via the DTR line of the COM port or upon the GSM module's activation by the alarm clock.



### 3.4. Watchdog timer types

Several types of watchdog timers are provided in the GSM modem:

- Built-in watchdog timer in the managing microcontroller. The microcontroller itself is monitored for a possibility of software crash (It is permanently on and cannot be turned off);
- A regular check by the managing microcontroller for a possibility of the GSM module deadlock of the Java-application. The interval can be set by the user in the range from 1 to 255 minutes in 1 minute increments. The principle of its operation implies that the managing microcontroller periodically sends the “at” command (speed 115200b/s, 8-N-1) to the second COM-port of the module and waits for a response “at”, then “OK”. Also, after each command, there should be “\r=CR \n=LF”. The response should be analogous to the response of the module without the Java-application with enabled echo. If no response is received the GSM module reboots. The module’s power in the meantime is shut down. This function can be activated or deactivated in the menu mode. This function is switched off by default;

**Note:** Java-application can occupy this COM-port, which will result in constant reloading of the module (where the function is activated).

- An unconditional reboot of the modem after a period of time set by user. This function is switched off by default. The period of time can be set between 1 and 255 hours in 1 hour increments. The principle of its operation implies that the managing microcontroller after a set period of time reboots the GSM module and the module’s power is shut down. The control of this function is done in the menu mode (see Part 4.3).



### 3.5. Menu Mode

The menu mode is intended to change the modem parameters and view the statistics. In this mode the GSM module power supply is disconnected, after the exit it is started automatically. You can jump to the menu mode from the operation mode by extracting the SIM tray. Before jumping into the menu mode, connect the modem to the computer through the connector DB9, start Hyper Terminal (time rate is 115200 bps, 8-N-1) or a similar program.

If you have entered the menu mode successfully, the LED indicator will flash frequently (see Table 2.6.1), the main menu will be displayed in Hyper Terminal:

Menu mode:

Variant XX

<P1> View statistics

<P2> WD interval = XXX hh (или "OFF")

<P3> 'AT' control = XXX min (или "OFF")

<P4> Sleep mode = OFF (или "ON")

<PC> Power control

<PR> Clear statistic,

where **Variant XX** is the weaving version.

The characters <...> signify the control commands. Input of the command gets underway after clicking "Enter". In case of incorrect input, "ERROR" is indicated. There is no difference between the entered uppercase and lowercase characters.

After input of the command <P1> you jump to the statistics viewing menu:

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

ComPort\_is\_not\_Running = XX...X

Deadlock\_of\_Module = XX...X

Reset = XX...X





When the modem is used, the following situations are automatically saved:

**Power\_Modem** – number of modem connexions,

**Bad\_Power\_Modem** – number of power supply deviations of the modem from the allowed value,

**Power\_Module** – number of power supply feedings to the GSM module,

**Bad\_Power\_Module** - number of power supply deviations of the GSM module from the allowed value,

**Start\_Module** – number of successful GSM module starts,

**Bad\_Start\_Module** – number of situations where the GSM module did not start,

**ComPort\_is\_not\_Running** – number of situations: COM is not available (CTS signal),

**Deadlock\_of\_module** – number of the GSM module deadlocks,

**Reset** – number of restartings.

After the statistics output, you will jump to the main menu.

После вывода статистики произойдет переход в главное меню.

After input of the command **<P2>** you will jump to the WD menu:

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

**<Q>** Quit

WD interval=

In order to change the restarting interval, enter a number from 0 to 255 (input is after clicking “Enter”). The restarting interval is specified in hours. If you need to disable this function, enter 0. You should consider that after expiration of the specified time interval the modem will be restarted unconditionally. In case of incorrect input, the modem will indicate “ERROR” and display the WD menu again. If the restarting interval is entered successfully, or if the **<Q>** command is issued, you will jump to the main menu..

After input of the **<P3>** command you will jump to the ‘AT’ menu:

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

**<Q>** Quit

control=

In order to change the deadlock check interval, enter the number from 0 to 255 (input is after clicking “Enter”). The interval is specified in minutes. If you need to disable this function, enter 0.

In this menu the periodic check for GSM module’s deadlock is set up with the interval specified by the user. It is arranged as follows: the operating microcontroller on UART1 of the GSM module issues the “AT” command (time rate 115200 bps, 8-N-1), expects for response, and, depending on whether or not the response is received, restarts the module. This function is disabled on default.

**Note:** If you using remote Java-application’s update (OTAP), the interval of periodic inspection must be less than the time of Java-application’s loading. Usually is a 10 minutes max.



Upon incorrect input, the modem will display “ERROR” and represent the ‘AT’ menu again. If the restarting interval is entered successfully, or the <Q> command is issued, you will jump to the main menu.

After input of the command <P4> – you will jump to the power standby mode menu:

Mode = (0 - off, 1 - on)

<Q> Quit

Mode =

In order to change it, you need to enter <0> or <1> (input is after clicking “Enter”). Upon an incorrect input, the modem will display “ERROR” and represent the AT menu again. If the restarting interval is entered successfully, or the <Q> command is issued, you will jump to the main menu.

In this menu, the modem’s jumping to the power standby mode is blocked (OFF) or enabled (ON). That is, upon the module’s deactivation, the operating microcontroller will start the module or not.

After input of the <PC> command – you can view the input power supply voltage and module power supply voltage (accuracy of measurement 5%):

POWER Uin=12.0 Umd=3.9

where Uin is input voltage in volts, Umd is voltage on the GSM module in volts.

After the output you will jump to the main menu.

After input of the <PR> command you will jump to the statistics clearing menu:

Clear statistic?

<YES> YES

<Q> Quit

The collected statistics if cleared by the command <YES>. Upon an incorrect input, the modem will display “ERROR” and represent the statistics clearing menu again. Upon successful input or issue of the command <Q>, you will jump to the main menu.

After input of the command <M> the main menu will load again.

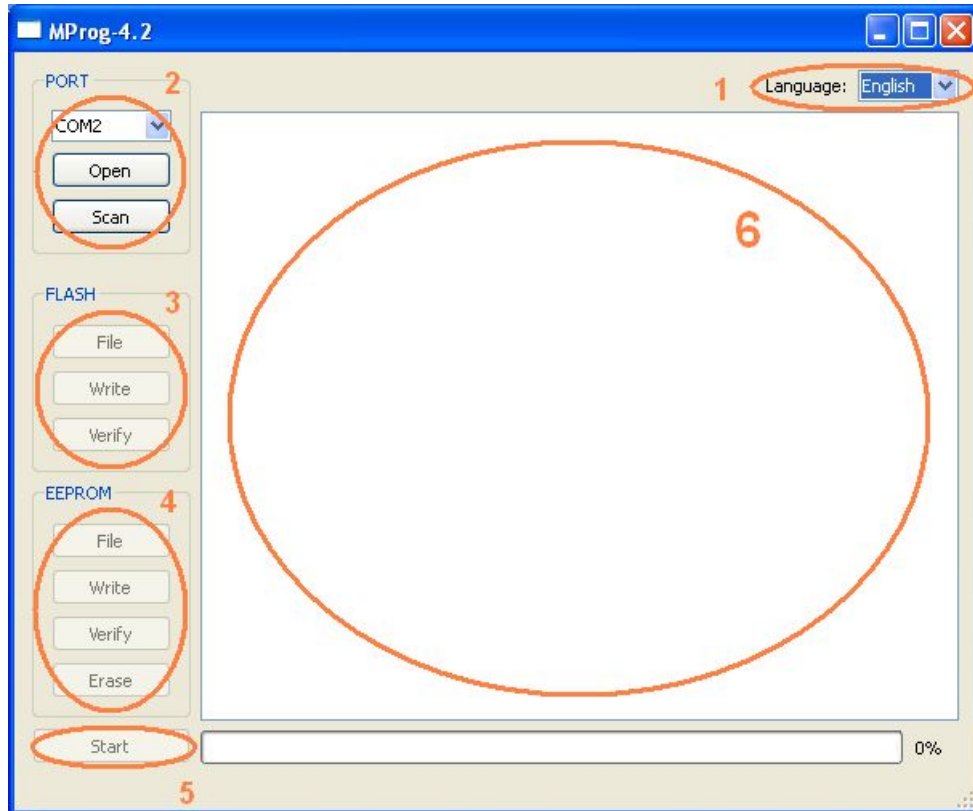
Exit from the menu mode occurs after installation of the SIM tray, the modem jumps to the operation mode.



### 3.6. Programming mode

Program “mprog” is used to change or update software of the managing microcontroller of the modem. Figure 3.2 shows an external view and main features:

1 – language, 2 – working with ports, 3 – working with Flash, 4 – working with EEPROM, 5 – start button, 6 – view window.



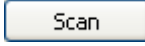
**Fig. 3.2.** Main view

If within 10 seconds after powering the device an update has not started, the modem will leave the programming mode and enter the menu mode.

To change the software do the following:


1. Start the program

Close all programs, which can use the port you will connect to the modem.

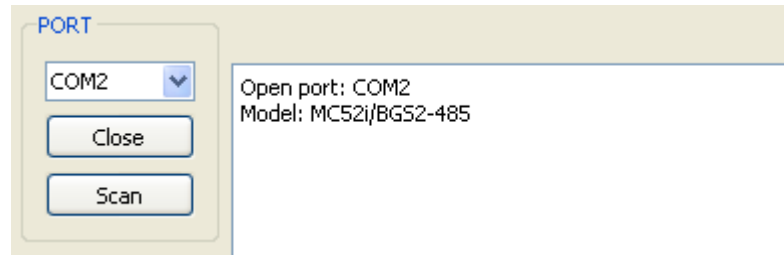
2. Click the  button in “Port” frame;
3. Choose the number of the COM port where the modem will be connected
4. Connect the modem (without the SIM holder) to the computer and turn on the modem;

Turn on the modem. The modem will go into the programming mode. The green LED will blink: 250ms on / 250ms off. “Open” button (not later than 10 sec once the modem was powered).




5. Click the  button (not later than 10 sec once the modem was powered) in “Port” frame;

The device model should appear. For example see figure 3.3 – “MC52i-485” (or “BGS2-485”).

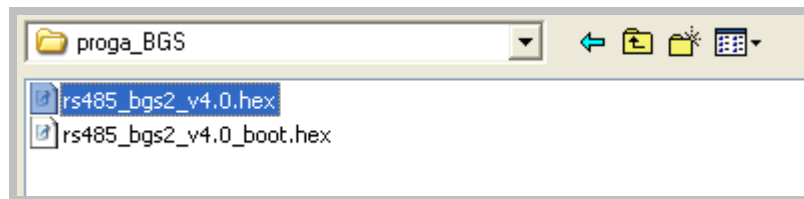


**Fig. 3.3.** Port opening

Then select the new firmware file to be downloaded.

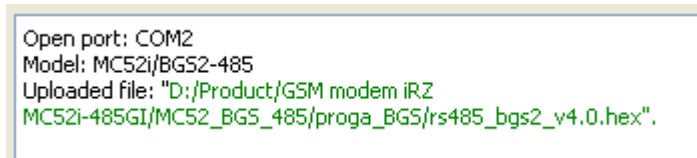
6. Click the  button in “Flash” frame and choose firmware file (file in “hex”-format) in «Open file» dialog

For example see figure 3.4 – “rs485\_bgs2\_v4.0.hex”.



**Fig. 3.4.** File uploading

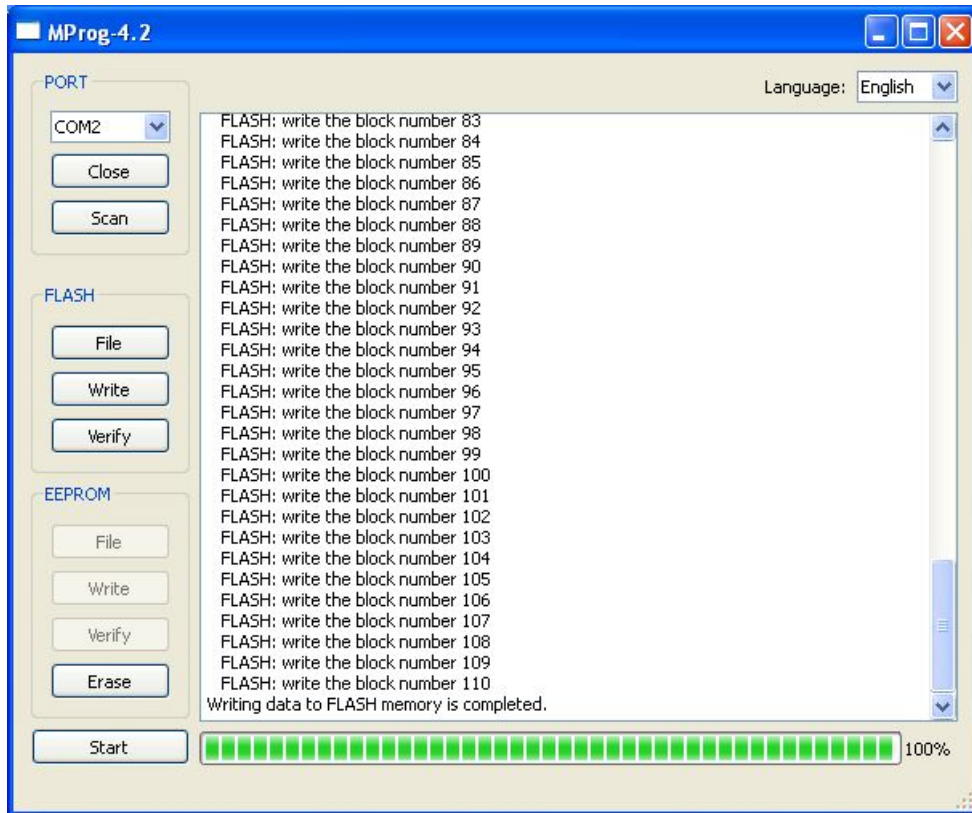
If the file has uploaded successfully, the program window will show message “Uploaded file:”.




**Fig. 3.5.** File is uploaded

7. Click the  button in “Flash” frame

After this, data will be written in Flash-memory and you see such text:



**Fig. 3.6.** Flash-memory writing

8. Next click the  button in bottom part of program window;  
This will make the modem exit from programming mode and the port will be closed.

```
FLASH: write the block number 107  
FLASH: write the block number 108  
FLASH: write the block number 109  
FLASH: write the block number 110  
Writing data to FLASH memory is completed.  
Exit the programming mode.  
Close port: COM2
```

**Fig. 3.7.** Exiting program mode

9. Close the program  
10. Place the SIM holder into the modem  
The software update is completed. The modem goes into the work mode.



## 4. Creating, installing and deleting of Java-applications

This modem based on module Cinterion TC65i with built-in Java platform, which allows for many tasks. You can create, install and delete Java-applications with special tools from Cinterion company, “Module Exchange Suite” (MES) application. The software is available at [www.irz.net](http://www.irz.net), or from delivering on CD/DVD from our managers.

After «Module Exchange Suite» is installed, in the root directory shall be added the drive “Module”:

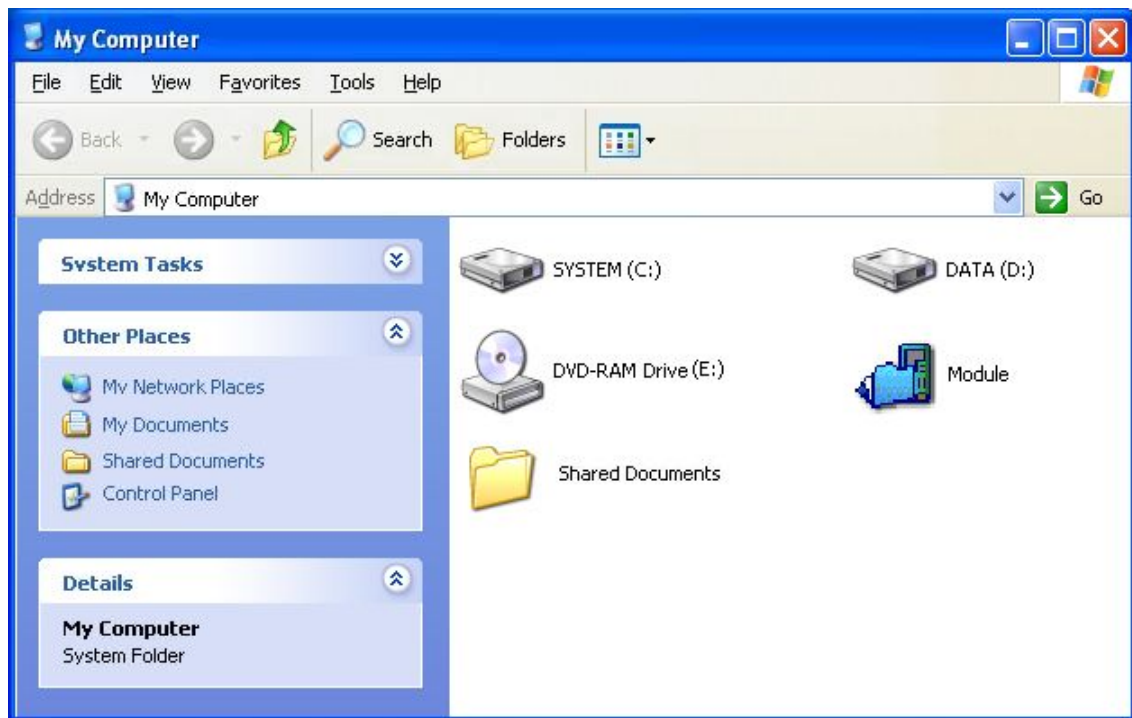


Fig. 3.6.1. My Computer window of Windows XP

In disk properties (Port tab) select COM-port, which connected with the modem:

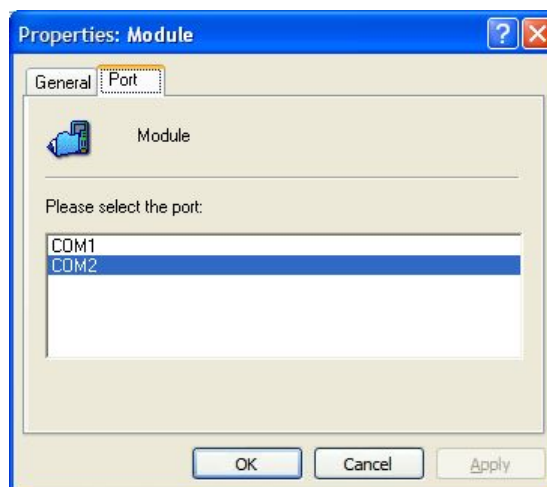
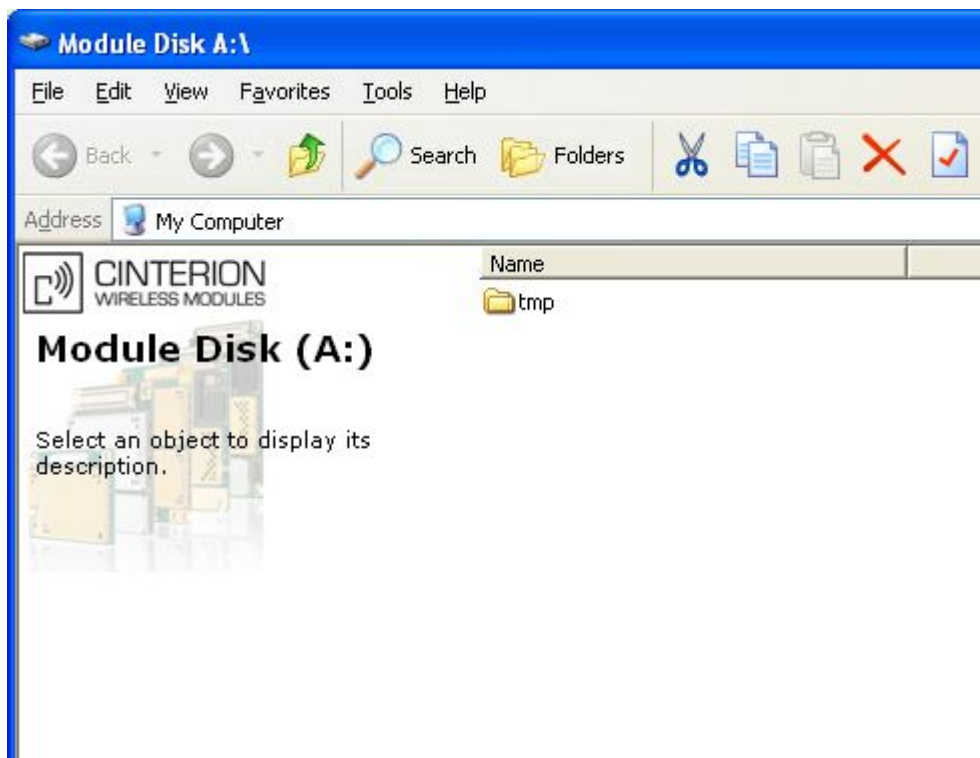


Fig. 3.6.2. Select COM-port



**Fig. 3.6.3.** Working with “Module” Disk

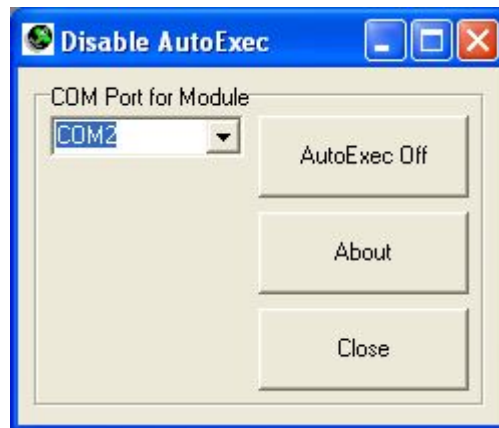
Working with “Module Exchange Suite” is to copy and delete needed files to disk “Module”. For example, to install the Java-based applications simply copy the files to disk “Module”.

Autostart of Java-based applications is given by the following AT-commands:

- `AT^SCFG="userware/autostart/appname", "", "a:/XXX.jar"` (where XXX is file name);
- `AT^SCFG="userware/autostart/delay", "", "100"` (autostart after 10 seconds after module is turned on);
- `AT^SCFG="userware/autostart", "", "1"` (autostart is enable).

For startup is recommended to set the interval of about 10 seconds. This is especially important when you testing the new Java-based applications. This further simplifies the process of abolishing the autostart. After the startup of Java-based application, port may not respond to AT-commands.

To remove Java-based applications, you need to cancel autostart. This can be done by AT-command **`AT^SCFG="userware/autostart", "", "0"`** if it was set in advance sufficient interval of autostart. You must sent this AT-command should be after 2-5 seconds after the power to the modem. After a successful attempt to sent AT-command, the modem must answer “OK”.



**Fig. 3.6.4.** General view of «AutoExec» application

If the specified autostart interval does not allow send AT-command to cancel autostart, in this case use the program “autoexec\_off.exe” (attached to the development software). Sequence of actions shall be as follows:

- connect the modem to the computer,
- run «autoexec\_off.exe», and at the program window, enter the number of COM-port,
- power on the modem and after 1-3 seconds click on «AutoExec Off» button (need to get in the time interval between the start of the module and the launch of Java-based application).

If autorun is turned off, then message should appear: “AutoExec successfully switched off”.

To delete Java-based applications is to remove the files on the disk Module». Provides the ability to remotely update Java-based applications - «Over The Air Provisioning» (OTAP). More information can be found in the documentation, which is part of the disk with the software for developing.





## 5. Emergency Situations

To simplify the use of the modem, tracking of emergencies is provided.

### 5.1. Emergency 1 (input voltage invalid)

Emergency 1 occurs in case of deviation of the input power supply voltage from the allowed value. In such case the modem stops the operation: disconnects the power supply of the GSM module. It signals with the red LED about the emergency situation (turned on continuously). Escaping from the emergency situation is possible only after restoring of the input voltage.

### 5.2. Emergency 2 (power supply of the GSM module invalid)

Emergency 2 arises in case of deviation of the power supply voltage of the GSM module from the allowed value. In such case the modem stops its operation: disconnects the power supply of the GSM module. It signals with the red LED about the emergency situation (0.5 s on / 0.5 s off). Escaping from the emergency situation is possible only after restoring of the power supply voltage of the module within 10 seconds from the time when the emergency situation occurred. If the power supply voltage of the module stays incorrect within 10 seconds (with correct input voltage), the modem jumps to the standby mode — the module power supply is disconnected, the emergency indication persists. Escaping from the standby mode is possible only after full disconnection of power supply.

In case of any repeated emergency after restarting of the modem, the modem is to be repaired.

### 5.3. Emergency 3 (GSM module not started)

Emergency 3 occurs in case where the GSM module is not started. Red LED signaling about the emergency situation: 0.25 s on / 0.25 s off / 0.25 s on / 1 s off. Escaping from the emergency situation is possible only after successful start of the GSM module. In case of 10 consecutive failed attempts to start the module (15 seconds), the modem jumps to the standby mode — the module power supply is disconnected, the emergency indication persists. Escaping from the standby mode is possible only with full disconnection of the power supply.

In case of any repeated emergency after restarting of the modem, the modem is to be repaired.

### 5.4. Emergency 4 (COM port unavailable)

A Emergency 4 arises if case of unavailability of the GSM module COM port. Red LED signaling about the emergency situation 0.25 s on / 0.25 s off / 0.25 s on / 0.25 s off / 0.25 s on / 1 s off. Escaping from the emergency situation is possible upon the availability of the GSM module COM port. In case of 10 consecutive failed attempts (20 seconds), the modem jumps to the standby mode — the module power supply is disconnected, the emergency indication persists.

In case of any repeated emergency after restarting of the modem, the modem is to be repaired.



## 6. Support

New document versions and software are available using:

<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 support team is ready to assist you with any questions you might have when installing, configuring or solving issues with our equipment.