

FGM410

GSM/GPRS/UMTS/LTE modem

User manual



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1. INTRODUCTION

The **FGM410** modem is used for remote connection (eg. remote meter readout) via serial interfaces.

The modem has two serial interfaces:

1. Serial interface #1: RS485;
2. Serial interface #2 can be:
 - RS232;
 - RS485 (optional);
 - CL 20mA (optional).

The serial interfaces can work independent and in parallel. A separate TCP/IP port is set-up for each.

Communication is done via the mobile network with GSM, GPRS, UMTS /3G/ or LTE /4G/ connectivity.

The modem is suitable for communication via IEC62056-21, IEC62056-46 as well as other protocols that require small time delays or higher volume of data.

The housing provides a three mounting points (per DIN 43857-5).

2. OPERATING PARAMETERS

The operating parameters are set up with the help of an application that runs under Microsoft Windows 7 or newer.

There are a few ways to connect with the modem:

- Directly via the serial interface RS485 / RS232 /CL 20 mA;
- Directly via optical probe (IEC 62056-21) - optional;
- Remotely through CSD/GPRS/3G/4G.

In case that the default settings do not provide successful registration with the network, the modem parametrisation has to be done directly.

3. TECHNICAL DATA

3.1. MODEM

- Mobile networks:
 - LTE-FDD: B1/B3/B5/B7/B8/B20/B38/B40/B41
 - WCDMA: B1/B5/B8
 - GSM: 900/1800MHz
- Output power:
 - GSM/GPRS power class:
 - EGSM900: 4 (2W)
 - DCS1800: 1 (1W)
 - EDGE power class:
 - EGSM900: E2 (0.5W)
 - DCS1800: E1 (0.4W)
 - UMTS power class: WCDMA: 3 (0.25W)
 - LTE power class: 3 (0.25W)
- Communication speeds:
 - GPRS multi-slot class 12
 - EDGE multi-slot class 12
 - UMTS R99 speed: 384 kbps DL/UL
 - HSPA+: 5.76 Mbps(UL), 42 Mbps(DL)
 - FDD-LTE CAT 1: 10 Mbps (DL), 5 Mbps (UL)
- Circuit Switched Data
- Antenna connection: SMA or FME 50 Ω
- SIM card: 3V / 1.8V
- Mini SIM (2FF)

3.2. POWER SUPPLY

Power consumption with typical signal strength ($\sim -80 \div -90$ dBm):

- Standard power supply: AC/DC 90 - 265 V, 50/60 Hz.

Voltage	Network	Mode	I [mA]	P [W]	cosφ	S [VA]
230V	4G	Registered	21.29	2.212	0.46	4.801
		Active session	31.86	3.984	0.545	7.314
	3G	Registered	20.69	2.07	0.44	4.89
		Active session	43.18	5.469	0.55	9.92
	2G	Registered	13.7	1.15	0.36	3.18
		Active session	29.1	3.27	0.49	6.75
100V	4G	Registered	37.93	2.036	0.592	3.44
		Active session	73.7	3.923	0.598	6.55
	3G	Registered	35.6	1.835	0.57	3.44
		Active session	64.7	3.788	0.648	5.484
	2G	Registered	17.8	1.09	0.61	1.78
		Active session	46.7	2.89	0.61	4.67

- Version with lower DC 15-48 V power supply (optional).

Voltage	Network	Mode	I [mA]	P [W]
24V	4G	Registered	88	2.12
		Active session	280	6.74
	3G	Registered	91	2.18
		Active session	206	4.95
	2G	Registered	76	1.83
		Active session	181	4.35

3.3. SERIAL INTERFACE #1

Type	RS485
Maximum number of peripheral devices	31
Baud rate	From 300 up to 115200bps Auto (per IEC62056-21) - optional
Transfer mode	Two wire, half duplex
Maximum distance	Up to 1100 m
Data format	7E1, 8N1, Auto 7E-8N switch

3.4. SERIAL INTERFACE #2

3.4.1. RS232

Type	RS232
Maximum number of peripheral devices	1
Baud rate	From 300 up to 115200bps Auto (per IEC62056-21) - optional
Transfer mode	Two wire, full duplex
Maximum distance	Up to 15 m
Data format	7E1, 8N1, Auto 7E-8N switch

3.4.2. OPTIONAL RS485

Type	RS485
Maximum number of peripheral devices	31
Baud rate	From 300 up to 115200bps Auto (per IEC62056-21) - optional
Transfer mode	Two wire, half duplex
Maximum distance	Up to 1100 m
Data format	7E1, 8N1, Auto 7E-8N switch

3.4.3. OPTIONAL CL

Type	CL 20mA (active or passive)
Maximum number of peripheral devices	6
Baud rate	From 300 up to 19200bps Auto (per IEC62056-21) - optional
Transfer mode	Two wire, half duplex
Data format	7E1, 8N1, Auto 7E-8N switch

3.5. OPTICAL PROBE (OPTIONAL)

Baud rate	From 300 up to 9600bps*
Transfer mode	Asynchronous, half duplex
Data format	7E1, 8N1

* For further information check **6.1**.

3.6. HOUSING

- Ingress protection: IP54 (per IEC60529);
- Dimensions H/W/D: 178 x 100 x 54 mm;

- Operating temperature: $-25^{\circ}\text{C} \div 60^{\circ}\text{C}$;
- Humidity: up to 95% without condensation;
- Installation: three point (per DIN 43857-5);
- The main cover and the terminal block cover can be sealed. This way the whole device is secured: SIM card, power supply, serial ports etc.

3.7. ANTENNA

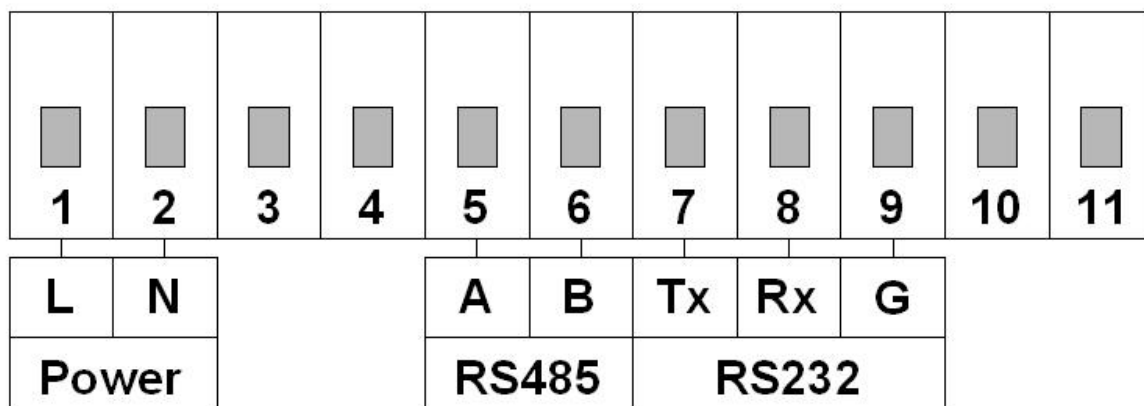
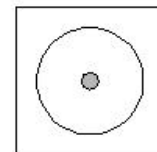
The modem is operating with external antenna that is using SMA or FME (optional) type of connection.

4. CONNECTING THE MODEM

The modem has two serial interface ports used for connection to peripheral devices (eg. electrical meters).

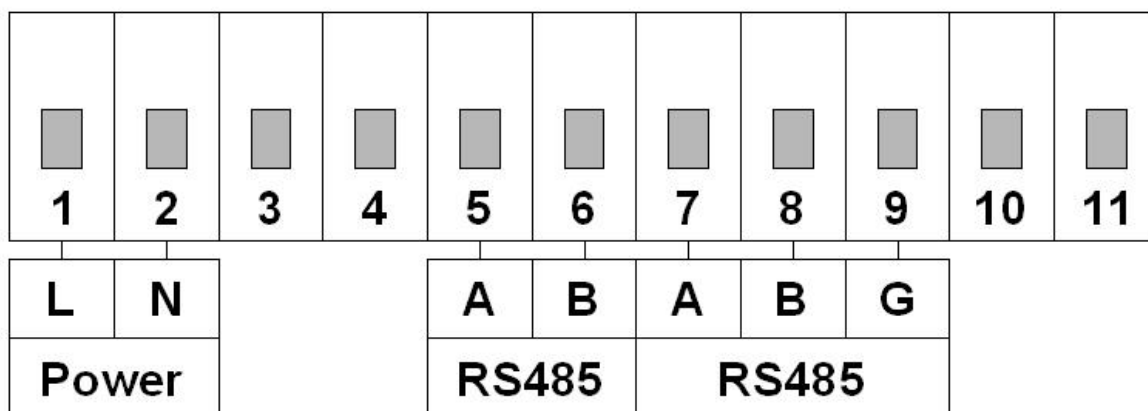
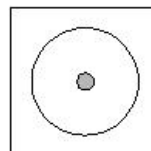
TERMINAL BLOCK (RS485 AND RS232)

Antenna



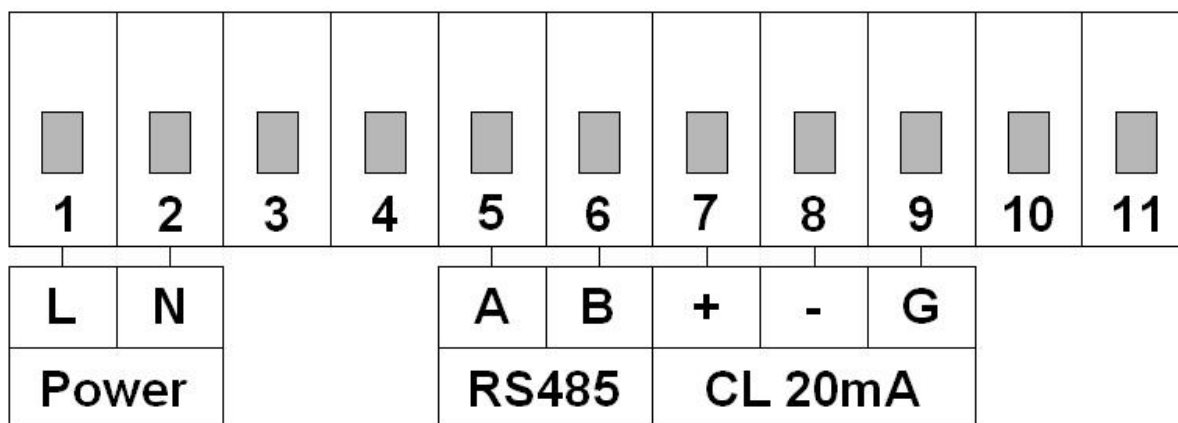
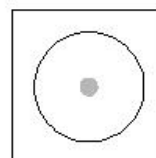
TERMINAL BLOCK (RS485 AND RS485)

Antenna



TERMINAL BLOCK (RS485 AND CL)

Antenna



4.1. POWER SUPPLY

Terminal	Term. No	Description
L	1	Modem power supply: 90-265V DC / AC 50/60 Hz
N	2	

4.2. SERIAL INTERFACE #1 RS485

Terminal	Term. No	Description
A	1	Signal A / RT+
B	2	Signal B / RT-

4.3. SERIAL INTERFACE #2

4.3.1. RS232

Terminal	Term. No	Description
Tx	7	Signal Tx
Rx	8	Signal Rx
GND	9	Signal GND

4.3.2. RS485

Terminal	Term. No	Description
A	7	Signal A / RT+
B	8	Signal B / RT-
GND	9	Signal GND

4.3.3. CL 20mA

Terminal	Term. No	Description
+	7	Current loop +
-	8	Current loop -
GND	9	Signal GND

4.4. TERMINATING THE RS485 INTERFACE

The RS485 terminating switch is accessible after removing the main cover.

Switch	Description
1 OFF	Enabled RS485 line termination
2 OFF	
1 ON	Disabled RS485 line termination
2 ON	

5. MODEM INDICATION AND OPERATIONAL STATES

Modems can be delivered preprogrammed with clients requested parameters (serial interface parameters, APN, PIN etc.) With the correct set up and network coverage, the modems connect automatically.

5.1. INDICATION

5.1.1. Power supply indication

Indicator	Description
Power	Presence of supply voltage

5.1.2. Mobile network status and active communication session indication

Indicator	Description
Network	<i>Illuminated:</i> - Modem is not registered in the network or - Active CSD call.
	<i>Blinking:</i> Modem is registered in the network
ST1	<i>Blinking:</i> Modem is registered in GSM/GPRS network
	<i>Illuminated:</i> Active session in GSM/GPRS network
ST2	<i>Blinking:</i> Modem is registered in 3G network
	<i>Illuminated:</i> Active session in 3G network
ST1+ST2	<i>Blinking:</i> Modem is registered in 4G/LTE network
	<i>Illuminated:</i> Active session in 4G/LTE network

5.1.3. Data transfer indication

Indicator	Description
RS1	Activity indication for serial interface #1
RS2	Activity indication for serial interface #2

5.1.4. Mobile network signal strength indication

GSM Signal is showing the signal strength of the mobile network after successful registration:

	Level 1 - very low signal strength:	<-90dBm
	Level 2 - low signal strength:	≥ -90dBm ÷ < -80 dBm
	Level 3 - average signal strength:	≥ -80dBm ÷ < -70 dBm
	Level 4 - high signal strength:	≥ -70dBm ÷ < -56 dBm
	Level 5 - very high signal strength:	≥ -56dBm

5.2. MODEM POWER UP

When powering up the modem and its successful registration in the mobile network an easy installation mode is automatically activated to determine the best position for the antenna (Check **6.3.2** for description of the full functionality of the installation mode).

When in easy installation mode the modem is constantly measuring the network signal strength (about each 2s). Depending on the GSM Signal diode indication signal strength can be approximated.

The easy installation mode is active until the first communication session. When connection with the modem is established, the easy installation mode is disabled.

5.3. RESET BUTTON

A **RESET** button is added, it is accessible after removal of the modems main cover.

Short press of the **RESET** button forces the modem to restart.

Long press of the button (>3s) is rebooting the modem with default settings (apn, tcp port, baud rate, parity, inactivity timeouts и etc.). Check **6.2** for settings description.

Successful loading of the default settings is indicated by the GSM Signal indicator blinking yellow-yellow-yellow.

5.4. SIM CARD

The modem operates with standard Mini SIM (2FF) cards.

The SIM cards nest is accessible when the modems main cover is removed.

ATTENTION!

Always switch off the modems power supply when inserting/removing the SIM card.

The **FGM410** modem supports PIN locked SIM cards. In this case the correct PIN code must be pre set. The modem can automatically unlock the SIM card during the start-up process and register in the mobile network.

In case that the PIN code is incorrect, the modem is indicating with quick flashing of the mobile network status indicator.

If there is only one try left to enter PIN (two previous tries failed), the modem will flash quickly the green ST1 diode and will discontinue further attempts to enter PIN. It is then required to unlock the SIM card on another device.

5.5. CDS COMMUNICATION (DATA CALL)

When making a DATA Call the modem is sending the received data (eg. device address) via both serial interfaces. On response from the device its serial interface remains active and used for communication during the DATA Call.

This procedure is applied each time a DATA Call is received.

5.6. TIME WINDOW

The **FGM410** modem has the ability to limit the connecting period in a time window.

To use this function it is required to synchronize the internal clock with NTP server. After a successful synchronization, connection with serial port #1 and serial port #2 will be possible only in the defined time window.

The time window function does not apply for accessing the modem configuration. Regardless of the set time window the modem is always accessible through the TCP/IP Port.

5.7. FIRMWARE UPDATE

The **FGM410** modem has the capabilities for local and remote firmware updating.

For further details check **6.3.5**.

6. FRODEXIM GPRS MODEM SET-UP APPLICATION

6.1. SETTINGS MENU

From this menu can be selected the type of communication with the modem. Options are:

- **Serial**: direct connection via optical port*, RS232, RS485, CL line;
- **GPRS**: connection via GPRS/3G/4G channel;
- **Modem**: connection via CSD channel.

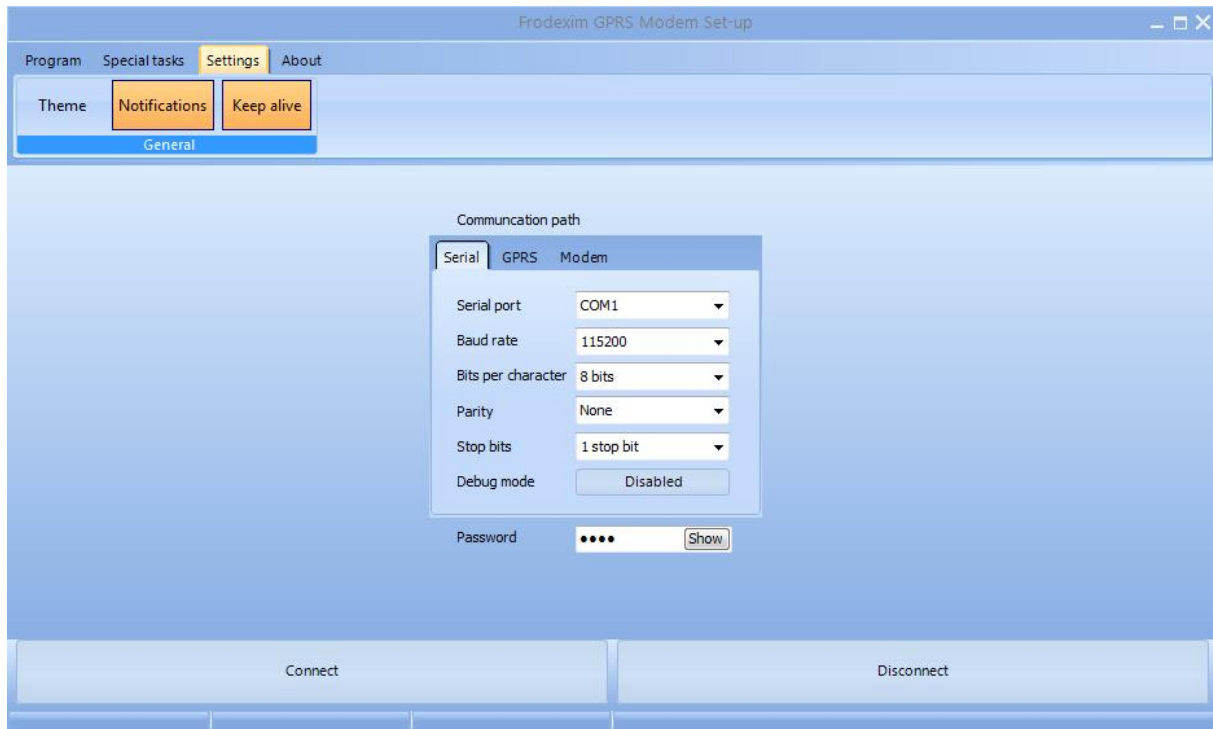
The (selected) sub menu (**Serial/GPRS/Modem**) is the active communication method used for establishing connection with the modem when pressing the **Connect** button.

- **Notifications**: Enabling/Disabling the message pop-up for successful operations (eg. saving settings).
- **Keep alive**: Enabling/Disabling the automated sending of messages for maintaining the configuration session between the Frodexim GPRS Modem set-up application and the modem. When the Keep alive function is disabled and the connection that is inactive for longer than what is set in **Session TO** the modem will automatically terminate the session and restart.

* The optical port has limited transfer of speed up to 9600 bps. In case that the modem is set up for higher transfer speed, the following options are available:

- loading of modems initial settings and then using the optical port;
- setup from the other available communication methods.

6.1.1. Serial submenu



Parameter	Description
Serial port	The serial port used to connect with the modem.
Baud rate	Serial interface data transfer speed.*
Bits per character	Data format.*
Parity	Data format.*
Debug mode	Used for troubleshooting.
Password	Password used to connect with the modem. Default value: 0000.*

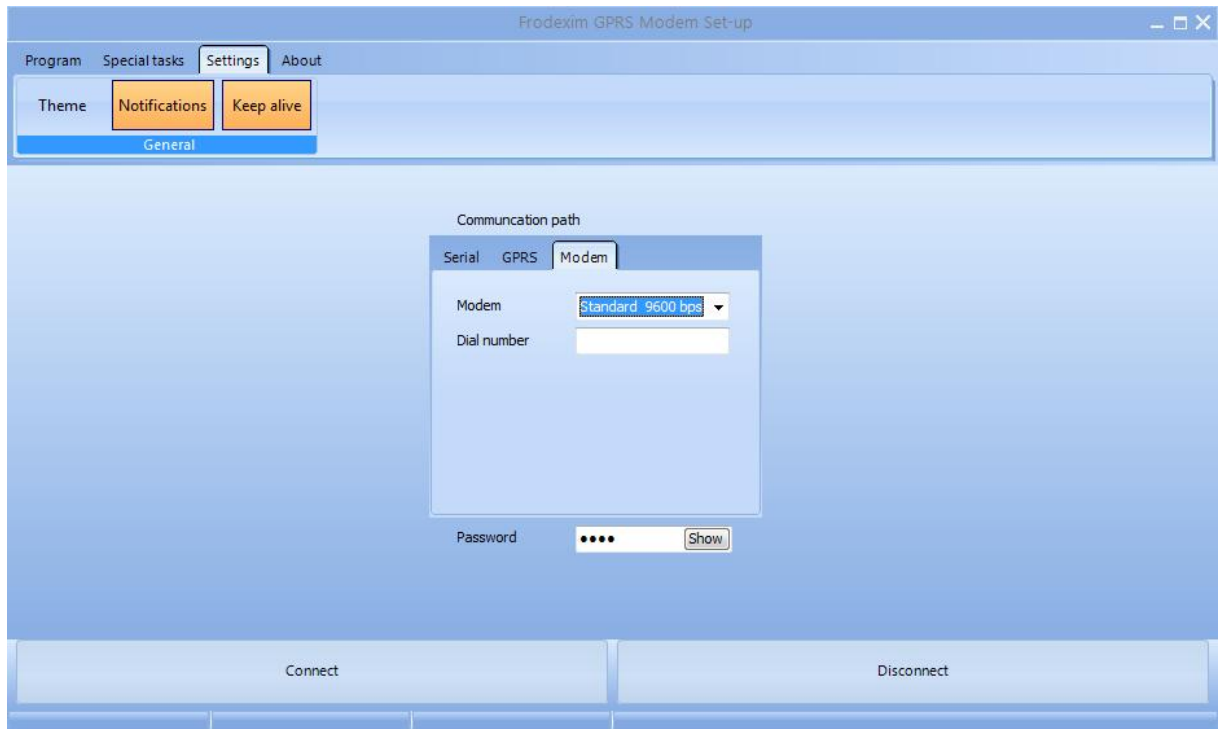
* Must correspond to modems settings.

6.1.2. GPRS submenu

Parameter	Description
IP Address	IP address to connect with the modem.
IP Port	IP port to connect with the modem.*
Password	Password used to connect with the modem. Default value: 0000.*

* Must correspond to modems settings.

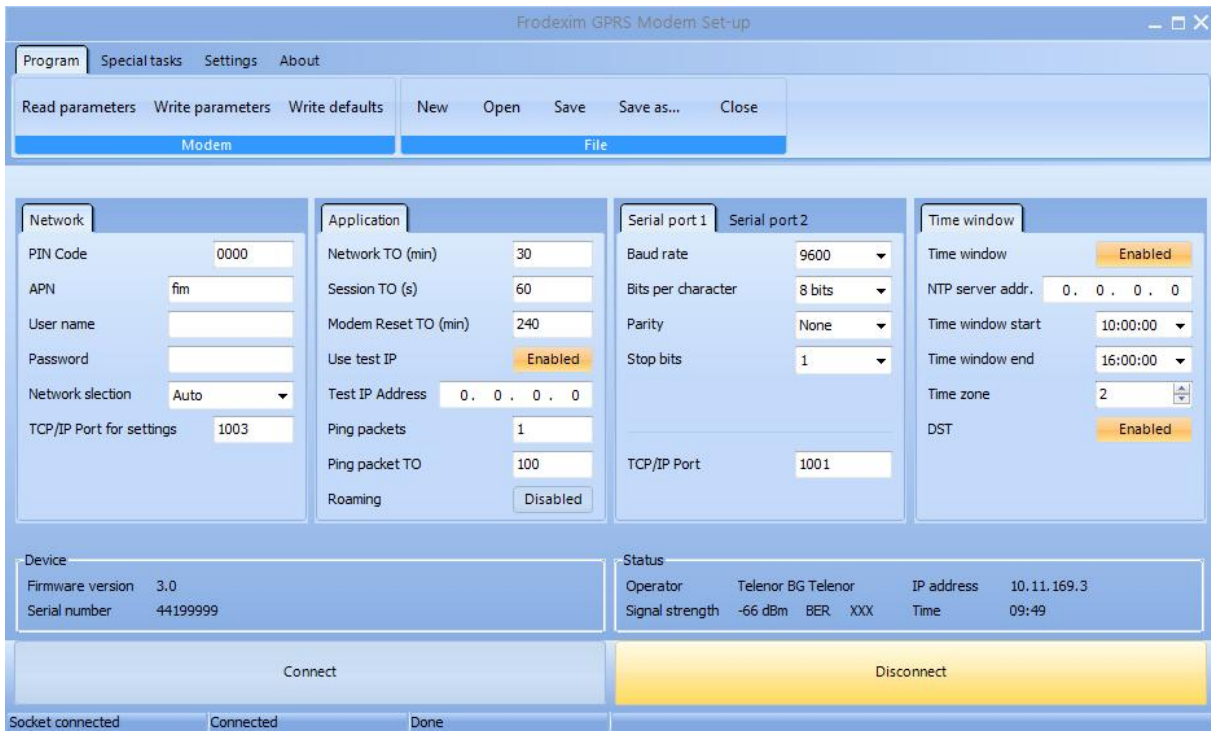
6.1.3. Modem submenu



Parameter	Description
Modem	Modem for connection. Must be set in advance on the pc used for making the connection.
Dial number	Cell phone number used for communication with the modem.
Password	Password used to connect with the modem. Default value: 0000.*

* Must correspond to modems settings.

6.2. PROGRAM MENU



Modems settings can be read/saved from this menu.

Connect button - creates connection with the modem.

After a successful communication with the modem is established the read/write parameters buttons become available:

- **Read parameters** button: reads the current modem settings;
- **Write parameters** button: writes the selected settings in the modem;
- **Write defaults** button: writes the selected values (excl. serial port) as default settings;

Disconnect button - terminates the connection with the modem. After the connection is terminated, the modem is restarted and applies the new settings.

Settings description

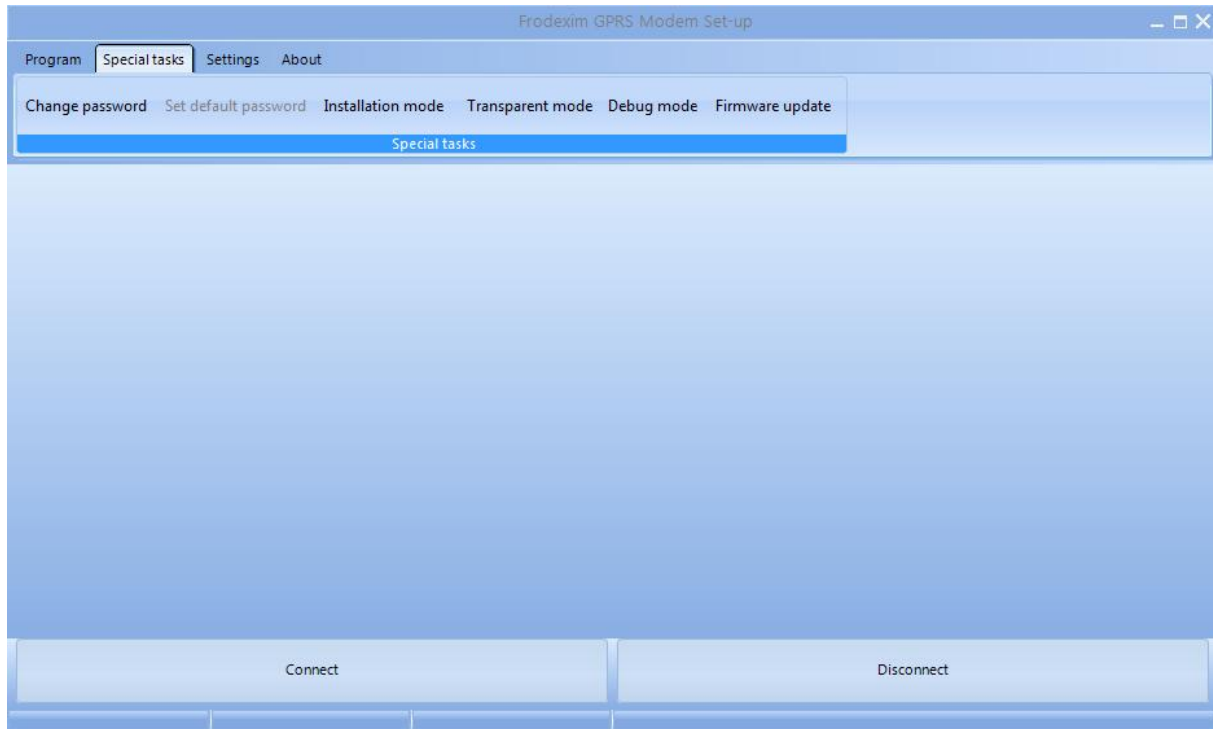
Parameter	Default value	Description
Network		
PIN Code	0000	PIN code. Not applied when its disabled from the SIM card.
APN	*	GPRS Access Point Name
User name	*	User name for registration in APN
Password	*	Password for registration in APN
Network selection	Auto	Selecting the type of mobile network
TCP/IP Port for settings	1003	TCP Port for configuration
Application		
Network TO	120	Time in minutes. The modem is checking connectivity with PING to <Test IP Address> on loss of communication session for longer period than set. If there is no response, modem is restarted.
Session TO	60	Time in seconds. The modem is restarted on loss of connection while in active session for longer period than set.
Modem Reset TO	180	Time in minutes. If there is no communication session established for longer period than set, the modem is restarted.
Use test IP	Enabled	Allowing the check connection functionality.
Test IP Address	0.0.0.0	IP address used for ECHO (PING) check of the GPRS connection. The modem is restarted if the test fails.
Ping packets	1	Number of PING packets sent to check the GPRS connection.
Ping packet TO	100	Maximum wait time for PING packet x 0.1s. (Setting 100 equals 10 seconds.)
Roaming	Disabled	Enabling/Disabling modem registration in Roaming.
Serial port 1/2		
Baud rate	9600	Data transfer speed of the selected serial interface.
Bits per character	8	Data format. *
Parity	None	
Stop bits	1	
TCP/IP Port	1001/1002	TCP Port for communication

Parameter	Default value	Description
Time window		
Time window	Disabled	Enabled/Disabled time window function. When enabled, the modem accepts communication sessions in the defined time window.
NTP server addr.	0.0.0.0	NTP Server address for time synchronisation of modems clock.
Time window start	00:00:00	Time window start.
Time window end	23:59:00	Time window end.
Time zone	2	Time zone in which the modem is present.
DST	Enabled	Enable/disable of the automated summer time switch
Device		
Firmware version	-	Firmware version of the modem.
Serial #	-	Serial number of the modem.
Status		
Operator	-	Current mobile operator.
IP address	-	Modem IP address.
Signal strength	-	Mobile network signal strength.
Time	-	Time (HH:mm) (Time window enabled)

* When Bits per character 7 and Parity Even (7E1) are set and HDLC Frame Flag is present in the beginning of the communication, the modem automatically changes data format to Bits per character 8 and Parity None (8N1).

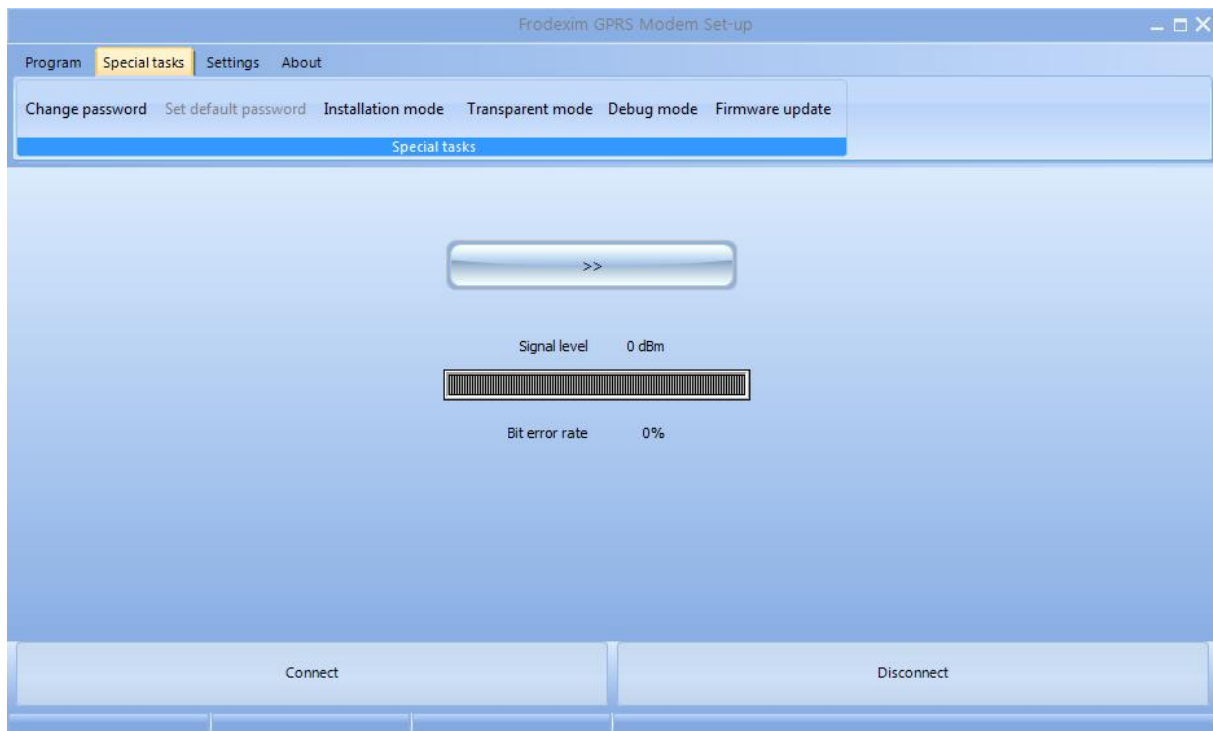
6.3. SPECIAL TASKS MENU

6.3.1. Change Password / Set Default Password submenu



- **Change Password** - the password used for remote access to the modems parameters can be changed;
- **Set Default Password** - the default password used for remote access to the modems parameters can be changed.

6.3.2. Installation mode submenu



The Installation mode submenu is used to enable the mode.

Installation mode is only enabled in local network(RS485/RS232/Optical port). Up on activation, the screen will periodically show information about the strength and quality of the mobile network. This method is used to find the best suitable position for the antenna.

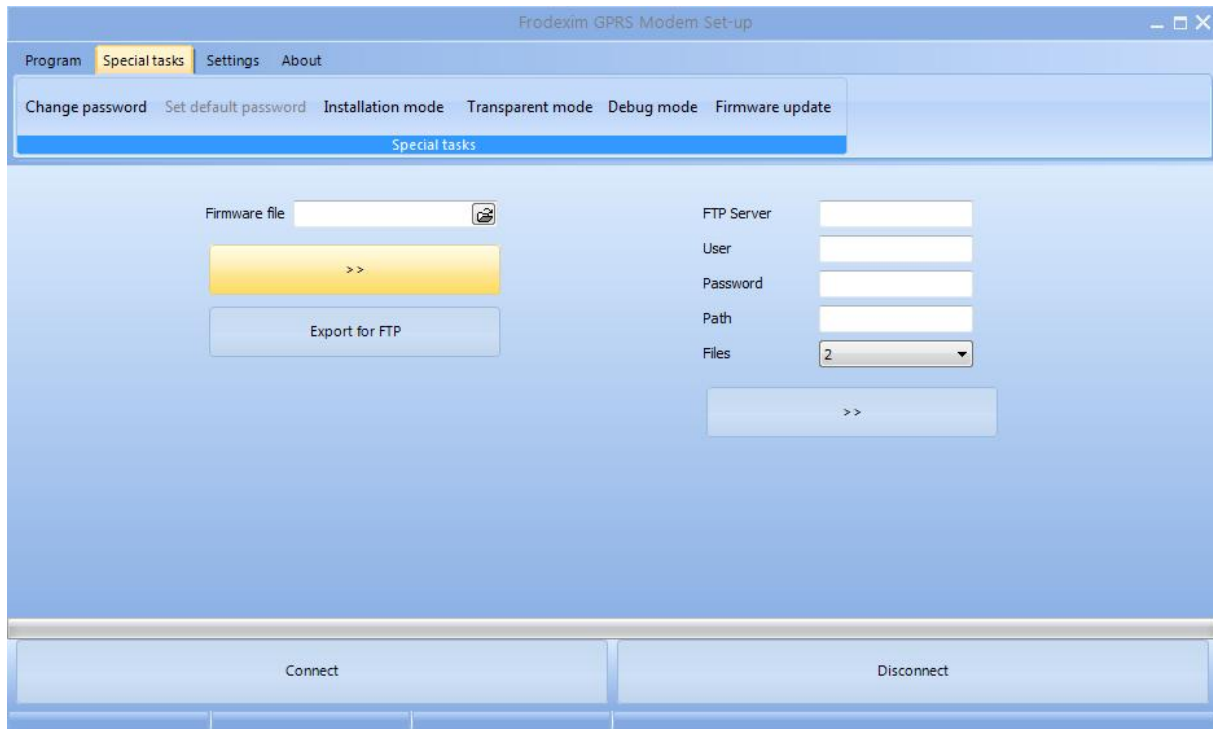
6.3.3. Transparent mode submenu

Used for troubleshooting.

6.3.4. Debug mode submenu

Used for troubleshooting.

6.3.5. Firmware update submenu



From the Firmware update submenu is allowing to update the firmware of the modem.

6.3.5.1. Direct update

After establishing connection with the modem:

- **Firmware file:** shows the destination to the file (<name>.hex) containing the firmware;
- Button ">>": Initiates loading of the file.

After a successful loading of the firmware, the connection is disabled automatically, the modem is restarted and applies the new firmware version.

6.3.5.2. Update via FTP

After establishing connection with the modem:

- **FTP Server:** IP address of the FTP server, where the new firmware is positioned (files fw1.bin/fw2.bin/fw3.bin);
- **User:** username used to access the FTP server;
- **Password:** password used to access the FTP server;
- **Path:** path to firmware file (empty if in Home directory);
- **Files:** number of files containing the new firmware;
- Button ">>": Sends update command to the modem.

After sending the update command, communication is automatically terminated and the modem connects with the FTP server. On successfully

established connection the modem downloads the new firmware, saves the file in the same directory named <serial number>.fwu for confirmation and applies the update.

7. STANDARDS

Radio equipment	BDS EN 301 489-1 V2.1.1:2017
Electromagnetic compatibility	BDS EN 55032:2015 Radiation requirements
	BDS EN 61000-3-2:2014 Limits for harmonic current emissions
	BDS EN 61000-3-3:2013 Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
	BDS EN 61000-4-3:2006/A2:2010 Stability of transmitted radio frequency magnetic field
	BDS EN 61000-4-2:2009 Stability of electrostatic discharges
	BDS EN 61000-4-4:2012 Stability of electrically quick transient process/impulse packet
	BDS EN 61000-4-6:2009 Stability of conductive disturbing impacts, induced from radio frequencies
	BDS EN 61000-4-11:2004/A1:2017 Stability of short period voltage drops, short period interruptions and voltage alterations
	BDS EN 61000-4-5:2006 Surge immunity
Safety	BDS EN 62368-1:2014/AC:2015 – Insulation: reinforced; – Overvoltage category: III; – Degree of pollution: 2; – Altitude: up to 2000m;