

GSM-MODBUS-485

1. Introduction

GSM-MODBUS-485 (hereinafter referred to as GSM-MODBUS) is intended for **remote access to devices** with RS485 using protocol **MODBUS RTU**. Usual devices are smart sensors, frequency converter, electricity meter, water meter or even PLC. GSM-MODBUS supports both **MASTER** modes.



Remote control means to get a SMS whenever a register in monitored device goes out of limits or a way to change values in registers of connected device. Beside the serial port GSM-MODBUS is equipped with one auxiliary digital input and one digital output. The inputs can watch digital output of connected device and the output can be used to reset monitored device in case of emergency. Predefined registers in connected devices can be queried via SMS

There is an internal **built in Li-POL accumulator** which allows to send an SMS in case of a power failure and to restore the output status after a power failure. It's also possible to monitor the status of inputs and temperatures via SMS during 230 V_{AC} power failure. A plastic holder to mount GSM-MODBUS onto a **DIN rail** can be supplied as an accessory.

We offer free program [SeaConfigurator](#) for detailed configuration. The GSM-MODBUS can be configured either via USB port or remotely via GPRS connection to the internet. Internal **data logger** keeps records about events and valued of inputs.

2. Package Contents

- 1pc GSM-MODBUS-485
- 1pc GSM antenna GSM-ANT05S
- 1pc 8-pin connector (pitch 3,5 mm)
- 1pc 2-pin connector (pitch 3,5 mm)
- 1pc screwdriver 2mm

Recommended accessories: 1pc mounting holder for DIN rail (ordering number [GSM-75-DIN](#)).

3. First Time Startup

- For proper device operation a SIM card is required. The SIM card has to be functional, activated and with disabled PIN code. Prepaid credit cards must have nonzero credit. Disabled PIN code allows you to start using your device without the need of connecting it to PC and SeaConfigurator first.
- Insert the SIM card into the SIM card holder and connect antenna. You will hear slight click when you insert the SIM card correctly. You can remove the SIM card later by slight push on it, until a click is heard. Now SIM card can be easily pulled out of the device.
- Connect power supply 8V to 30V DC (see chapter Technical Specification).
- Green LED PWR will light up when the device is powered properly. At the same time blue LED GSM start to blink 1:1 (=registering into GSM network) and after approximately **20 seconds** the blinking changes to **blink once per 4 seconds** (=registered successfully).
- Send SMS message "1234 on" from your mobile phone to the phone number of SIM card inserted into GSM-MODBUS. This will turn on the digital output of your GSM-MODBUS, lights up green LED OUT and generate a response SMS to you. It also stores your phone number as the first user into User List.
- This will allow you to control the digital output and read the digital input of GSM-MODBUS. Additional function has to be configured using SeaConfigurator, see chapter Configuration.
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4. Technical Specification

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	
Dimensions	Width	W	54		mm	
	Height	K	24		mm	
	Depth	D (without connectors)	86		mm	
Power Supply	Voltage	During phone call	8 V DC	12 V DC 2,8W	30 V DC V DC	
	Standby	Only registered to GSM net		12 V DC 90mA	W	
Digital input	signal relay, designation Y2 (OUT)					
	Voltage	V	3	12	60	V
Digital output	designation X3 (IN) potential free contact					
	Current	I			2	A
Temperature	Operational	t _a	-20		+45	°C
	Storage	t _{stg}	TBD		TBD	°C

GSM-MODBUS must be used inside of a switchboard with at least IP44!



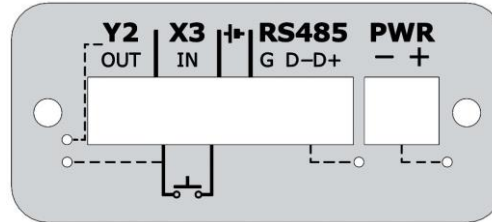
WARNING!
You must use the device according to all safety standards in order to avoid electric shock!

5. Hardware

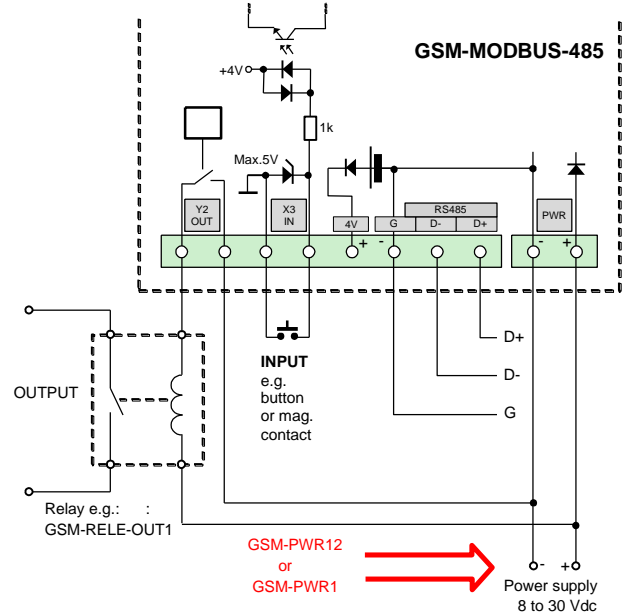
5.1 Power Supply, Input, Output and Serial Port

Power supply connector has 2 pins. Allowed power supply is from +8 V DC to +30 V DC. Signal connector has 8 pins and contains digital output (contact of relay), potential free input (optically isolated), +4V output from internal battery and communication port.

PIN	Description	Parameter
Y2 (OUT)	Isolated relay contact	60 V / 2 A
X3 (IN)	Optically isolated digital input with serial resistivity 1 kOhm	max. 5 V DC
Battery Symbol	Positive contact of internal battery with safety resistor of 100 Ohm inside	4 V, max. 10 mA
G	Common for RS485 and minus of ACU	
D-arrow in	negative signal RS485	according to RS485
D+ arrow out	positive signal RS485	according to RS485
PWR	Power supply	from +8 V DC to +30 V DC



5.2 Typical Application



Termination resistors for RS485:

An RS-485 bus consists of multiple transceivers connecting in parallel to a bus cable. To eliminate line reflections, each cable end is terminated with a termination resistor, whose value matches the characteristic impedance of the cable. This method, known as parallel termination, allows for higher data rates over longer cable length. There is a DIP switch inside of GSM-MODBUS-485 (the middle one) allowing to connect 120 Ohm resistor between D+ and D-.

Two other switches allows to define idle state of the RS485 bus by connecting D+ to 3 V via resistor and D- to GND via resistor.

You need allen key 2 mm to open the box of GSM-MODBUS-485.

5.3 LEDs

LEDs located on the front panel:

LED	Color	Description
GSM	Blue	State of the device
		off ... starting up (Core)
		blinking 1:1 ... starting up (GSM)
		blinks short 1x per 4s ... ready

LEDs located on the back panel:

LED	Color	Description
PWR	green	off ... not powered on ... powered from PWR connector blinks ... powered from internal battery
Tx Rx	red green	GSM-MODBUS is transmitting GSM-MODBUS is receiving
OUT	Green	off ... output Y2 is off on ... output Y2 is on blinks ... regulation or RESET
IN	Green	on ... intuo is on H state

5.4 SIM Card Holder, Button, USB and antenna

Insert SIM card according to image below. Push on the SIM card until slight click can be heard. Remove SIM card by pushing on it again until slight click is heard. Now you can easily pull the SIM card from the device.



Short press of the button can be used to toggle state of the output. Long press of the button while powered from battery causes entering sleep mode. Wake up is possible by applying voltage in PWR connector. Long press of the button while powered from PWR connector can be used to restart the device.

Micro USB connector is used for configuration of via SeaConfigurator. Antenna is connected via SMA connector. The device has SMA female connector, antenna has to have SMA male connector. Antenna is of impedance 50 Ω.

5.5 Internal Battery

GSM-MODBUS has internal rechargeable Li-Ion battery 3.7 V. In case of main power failure the device can stay functional up to one day (depends on how many MODBUS registers are monitored/controlled and GSM signal quality).

In case of failure of the main power supply, the device can send an SMS message. The settings are made in **SeaConfigurator** – the power supply is listed on the Digital inputs tab under the name **PWW**.

Digital Inputs						
Label	Monitoring and Control	Input activated		Input deactivated		Users
		Name	State L	State H	SMS Message	
X3	✓ X3	vyp	zap			More...
X10	✓ X0(001001)	off	on			More...
PWW	✓ Power	battery	main	Power supply rest	Power supply fail	MASTER More...

6. Configuration

The configuration (parameter setting) can be done using program **SeaConfigurator**. For connection to PC device has micro USB connector or you can use GPRS connection. This configuration program can be downloaded free of charge from the website www.seapraha.cz (enter the word "Configurator" in the search) and installed on a PC. Follow the instructions in the installation wizard to install the downloaded program.

8. After connecting (see chapter Typical application) your devices to the RS485 terminals, you can monitor and set the registers of these devices and receive SMS about events when required register changes, see chapter Control.

Connect the GSM-MODBUS to the PC with a micro USB cable (ATTENTION! USB is not used to supply GSM-MODBUS). If the SeaConfigurator is installed correctly, this software will start automatically (within approx. 0.5 minutes) and the factory configuration will be read from GSM-MODBUS.

On the **Settings / General** tab, use the Station settings button in the **External communication** section to select the speed and other parameters of the connection to the COM port.

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10. Factory setting GSM-MODBUS is MASTER, 19200Bd, 8-E-1.
- 11.
12. On the **Settings / General** tab, press the **More** button in the line with SLAVE device (in the factory setting marked as PLC1).

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15. Select the Number of registers and their type for SLAVE device (in the factory

Index	Ser. No.	Inputs + Outputs	Name	Status	Details
0	GF820013	Y2,X3	GSM-MODBUS-485	OK - Master	More...
10	MDB00001	1xY,1xX,1xA,1xB	PLC1	OK - Slave	More...

setting, one register of each type is selected). Next, set the address of the device in the Modbus network. It is also advisable to use SMS messages in case of loss of communication or resumption of communication.

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17.

Now it is necessary to gradually fill in the modbus addresses of the selected registers and enter the sending of SMS when the required change of registers. For the FATEK PLC, it is possible to enter the register designation directly in the FATEK format as the address, see the table at the end of the document

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Now it is necessary to gradually fill in the modbus addresses of the selected registers and enter the sending of SMS when the required change of registers. For the FATEK PLC, it is possible to enter the register designation directly in the FATEK format as the address, see the table at the end of the document.

The modified configuration still needs to be written to GSM-MODBUS by clicking on the To station button. If you leave the USB cable connected, you can monitor the current operating status of GSM-MODBUS on the "Monitoring" tab. For control, it is possible to define the names of commands that can be used to set register values in connected devices. Some configurations (parameter settings) can also be performed via SMS, see chapter List of commands.

It is also advisable to write the created configuration to a file. If you have more than one device in the SeaConfigurator, you will easily distinguish them according to the text in the Identification field - the file name will always start with this text, followed by the date and time of saving.

7. Control

7.1 Remote control via SMS messages

GSM-MODBUS is controlled via SMS of the GSM network. Text SMS are in form:

PASSWORD gap COMMAND gap COMMAND

Password (access code)

Password is a main security item for control of **GSM-MODBUS**. Command SMS are accepted from any phone number. It means anybody who knows the password and the phone number can control the **GSM-MODBUS**. The password is a string of digits (1 to 20) which must be on the beginning of any command SMS. Otherwise the SMS will be ignored. A text before the password is automatically ignored. It is useful when command SMS are sent from Internet GSM gates. The password can be changed using SeaConfigurator on the tab General or by a configuration SMS message. Default password set up by manufacturer:

1234

Command

This part of a message specifies a requested action. It is possible to insert several commands separated by a gap into one SMS message. The command can consist of several parts. For example, as far as the output is concerned, it consists of its name "Y2" and its own command (eg ON, OFF, etc.). If the output name is not specified, the command for the output with the lowest number applies. The ON and Y2 ON commands are therefore equivalent. In addition, a parameter can be specified after the command (eg pulse length, required temperature, etc.). A gap must be inserted between the command and its parameter.

List of commands you can find at the end of this document.

7.2 Status SMS message

If you send a command that contains a valid access password, GSM-MODBUS always responds with a command status message. Example: 1234 Y2 ON
If this is not disabled in the SeaConfigurator, it will also attach a status message. The status report contains the following information:
Note The status message can be shortened to a maximum of 160 characters (see option in SeaConfigurator).

Example status message	Explanation
GSM-MODBUS: Y2 ON DONE	Confirmation: OUT(Y2) was switched ON.
POWER=good	Power supply of GSM-MODBUS is OK.
Y2=on	State of output Y2(OUT)
X3=on	State of input X3(IN)
X10=on	State of input X10
sig=58%	Strength of GSM signal is 58%.

The number of rows depends on the number of modbus registers added. Disabled registers do not appear in the status report.

7.3 Control using CML (for Smart phones)



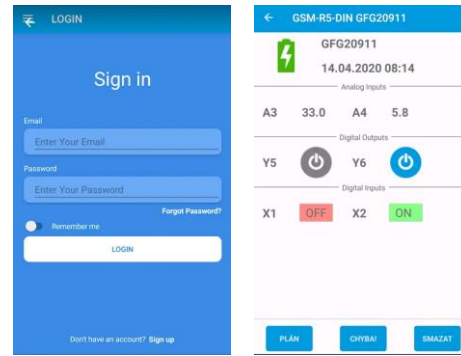
This application can use smartphones with Android or iOS. Application makes easier control of **GSM rele^s** and state monitoring. You can download this application from Google Play or Apple Store for free, type into search „**CML SEA**“. After installing the application, make the first registration, take a photo of the QR code of the device into the "paring code". The QR code you find in the **GSM rele^s** package.



WARNING: For the functionality of the CML application, it is necessary to have an activated data tariff on the SIM card, which is inserted in the device. Transferred data can be charged by the operator according to the tariff agreed by you.

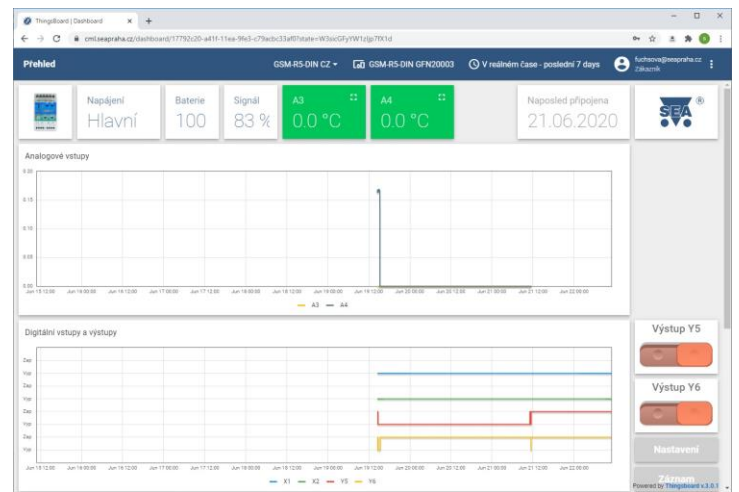
7.4 Enable CML

The CML function must be switched on in the GSM-Configurator in „Station settings“, press the edit button in the „CML“ line and check „Enable“ in the CML window.



7.5 On-line data on a website

You can monitor the measured values, including the history, and display them clearly on the **cml.seapraha.cz** website. You can also control the outputs or set up e-mails with alarm messages directly from the website.



8. Examples of remote control

The following examples describe the most commonly used ways to use GSM-MODBUS. The examples are based on the basic "factory" settings.
Note: If a MODBUS device with its own inputs and outputs is connected to GSM-MODBUS, GSM-MODBUS can be set up using the SeaConfigurator so that these inputs and outputs can be used in the same way as input and output to GSM-MODBUS.

8.1 Remote control

The device is connected to (via relay) the output OUT on GSM-MODBUS.

SMS message in following format **switches on** the device remotely:

1234 ON

SMS message in following format **switches off** the device remotely:

1234 OFF

Example:

1234 ON ... GSM-MODBUS switches on the output OUT and send confirmation SMS
1234 OFF ... GSM-MODBUS switches off the output OUT and send confirmation SMS
1234 Y2 ON NOBACK ... switches on the output OUT and don't send confirmation SMS

9. Datalogger

GSM-MODBUS can save (log) detailed information about device's actions. Saving period of analog values is set up in **SeaConfigurator** in settings of the station. Saved log can be used for analyzing activity of device. User can set up which information will be saved to log file during configuration of **GSM-MODBUS** via **SeaConfigurator**. It is possible to save information about input/output signals or received/send SMS messages. File type of log file is .csv (= Comma Separated Values). Name of log file is derived from actual date (data.csv). There are two types of log records: periodic and event. Event record contains actual analog values.

10. Event report

If an event occurs at the specified GSM-MODBUS input or output or the connected MODBUS device that lasts continuously for a certain time, GSM-MODBUS sends an SMS message about the event. Using the SeaConfigurator, it is possible to set the SMS message to be supported by the GSM ringing of the user by GSM-MODBUS. If you answer the call, GSM-MODBUS signals the event with a tone dialling sound (input from low to high tone closed; open from high to low tone).

11. Usage examples

11.1 Remote control of output

Output Y2 is possible to control via SMS.

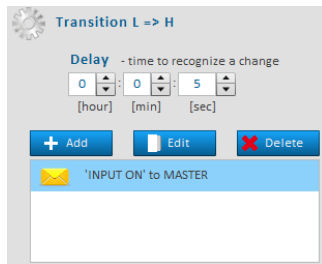
This SMS message will turn **ON** the device: 1234 ON

This SMS message will turn **OFF** the device: 1234 OFF

Note. If you changed the password 1234 to your own (e.g. 6543), then you need to send SMS with the new password: 6543 zap (6543 OFF).

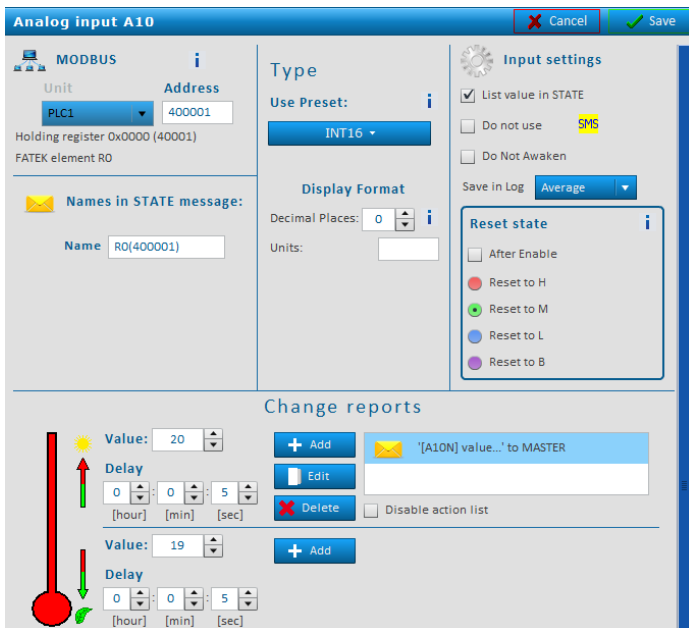
11.2 Input change notification

Input X3 on the device is intended for connection of a potential-free contact. When the contact is closed, an information SMS message can be sent to the set phone number. The message text can be configured in the device settings, using the More button on digital input X3. You can also set the message to be sent when the contact is disconnected.



11.3 Notification of register change in the connected device

The GSM-MODBUS device enables the sending of an information SMS message when the value in the register of the connected device changes. The picture below shows the configuration in which an SMS will be sent if the value of register 40001, for at least 5 seconds, is greater than 20. Messages are configured using the **More** button for analog inputs.



12. Warranty

General warranty period is 12 months after purchase, when eventual malfunction device will be repaired free of charge in SEA company while shipping to SEA is paid by customer and SEA pays for shipping back to customer. For SW there is 24 months warranty under following conditions:

Both CPU and PC software is sold "as is". The software was

created by the best software engineers in SEA and was carefully tested both in SEA and also by SEA customers using GSM applications products made in SEA. In spite of making all possible to get error free software it can happen, that the software in CPU or PC programming SW or their mutual interaction has some error under some specific conditions. If such error is found and the description of the problem including configuration file is sent by E-mail to SEA Ltd., the error is removed free of charge and SEA will send new SW by E-mail to customer.

SEA Ltd. has NO RESPONSIBILITY for any damage, lost, costs and any other problems direct or inducted, caused by such SW error, by eventual device malfunction from any reason or by undelivered SMS from the device.

The manufacturer, seller or installation company is not responsible for the amount of transferred data, connections, telephone calls, sent SMS, MMS, or other charged services of GSM network operators and is not responsible for the amount of fees for GSM network operators of the installed SIM card. Nor is it liable for the energy consumed by the equipment it controls or for any other damage.

CE Declaration of conformity

in accordance with the Radio and Telecommunications Terminal Equipment Directive 1999/5/EC (R&TTE) and Directive 2011/65/EU (ROHS).

We SEA, spol. s r.o., Dolnoměcholupská 1537/21, CZ 102 00 Praha 10, Czech Republic, ID: 47117931 (**manufacturer**) declare under our sole responsibility, that **product** device for remote control and monitoring type GSM-MODBUS is in conformity with the following standards:
health and safety: EN 62368-1:2015 + Opr.1:2016 + A11:2017
EMC: ETSI EN 301 489-1 v2.1.1 ETSI EN 301 489-52 v1.1.0
radio frequency: EN 301 511 v 12.1.10
ROHS: EN 50581:2012

The last two digits of year in which the CE marking was affixed: 18



Place of issue: Praha
 Date of issue: 3.4.2017

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13. Frequently Asked Questions (FAQ)

What is necessary to use the **GSM-MODBUS**:

- Good quality GSM signal in a place where *GSM-MODBUS* will be used (at least 2 bars on your mobile phone)
- Sufficient credit on a pre-paid SIM card
- No phone call redirection
- The user has to know to operate his mobile phone (PIN usage deactivation)

Problem description	Possible reason	Solution
LED GSM (blue) does non flashes within 3 minutes after switching on the GSM-MODBUS at intervals of once every 4 seconds	SIM card is not functional	Test the SIM card in your mobile phone. Try to make a call and receive a call from another mobile phone. Try to send a receive SMS message. Switch off using PIN on a SIM card. Cancel all call redirection for a SIM card. (Ask your mobile operator for help if necessary).
	New SIM card is not activated yet	New SIM card has to be activated. (Ask your mobile operator for help if necessary).
	Low credit on a pre-paid SIM card	Check credit on a pre-paid SIM card. (Ask your mobile operator for help if necessary).
	Weak/poor GSM signal	Test the SIM card in your mobile phone. The mobile phone should show the signal level at least 2 bars.
The pulse on an output is not generated based on incoming ring signal (e. g. for a gate opening)	The incoming phone calls for a SIM card are redirected	Cancel all phone call redirections for the SIM card
The MODBUS connection to the connected device does not work	Incorrect configuration Incorrect connection of RS485 data signals	Check the configuration in GSM-MODBUS and in the connected device (especially the correctness of the MASTER / SLAVE options and the settings of the serial ports) Swap RS485 bus data signals (D +, D-) If the communication does not work, only the Tx LED on the MASTER side flashes. Note: MASTER is identified by the fact that the LED (Tx) flashes even when the cable is disconnected
Item marked in red when configuring GSM-MODBUS using the SeaConfigurator program	Unsaved configuration to GSM-MODBUS (Occurs when changing MASTER / SLAVE)	Upload the configuration to the Station, this will delete this item.

14. List of commands (multiple commands can be in one SMS message)

Command	Parameter	Example	Description
ON		1234 on	Turns on output with lowest number and confirms it via SMS – Also attaches current state message if it isn't turned off in configurator.
Y2 OFF		1234 y2 off	Turns off corresponding output. Output name or number must be specified in command. In configuration you can name the output and then use that name in command.
OFF		1234 off	Turns off output with lowest number.
REG TEPL	Degrees [°C]	1234 reg 25.5	If no output name is entered, Output with lowest number will be regulated.
Y2 PULSE	seconds	1234 y2 pulse 3600	Turns on output with lowest number for one hour then turns it off.
RESET	seconds	1234 reset 86400	Turns off output with lowest number for one day then turns it on.
STATE		1234 state	Sends SMS message with state of device and with state of all enabled inputs/outputs.
NOBACK		1234 on noback	Execute command and doesn't confirm it.
IEN		1234 !en	Enables using output with lowest number.
X3 !DIS		1234 x3 !dis	Disables input X3. No state-change messages will be sent.
ISTOP	time	1234 !stop 12	Disables sending all event messages for 12 hours. Command 0 (=zero) cancels this command.
USER ADD	Phone number Phone number	1234 user add +420123456789 +420987654321	Adds user with Phone number +420123456789 and sets him same events as user +420987654321. If second number isn't entered. This user can only „ring“ (pulse).
USER DEL	Phone number	1234 user dis +420123456789	Disables user with Phone number +420123456789.
USER CHANGE	Phone number Phone number	1234 user change +420123456789 +420987654321	Change Phone number +420123456789 to +420987654321.
USER DIS	Phone number	1234 user dis +420123456789	Disable (but not delete) user with phone number +420123456789
USER EN	Phone number	1234 user en +420123456789	Enable user with phone number +420123456789
CODE ADD	password	1234 code add 12	Add new password 12 (password must be long from one to twenty numbers).
CODE DIS	password	1234 code dis 12	Disable password 12
CODE CHANGE	password password	1234 code change 12 123456	Change password 12 to 123456
REGISTER	number	1234 register 99887766	For GPRS connection is necessary send this SMS, enables station to register to server SEA spol. s r.o.
SET APN	APN name	1234 set apn „internet“	Sets GPRS APN name on word internet
SET APNUSER	User name	1234 set apnuser „“	GPRS user name sets as empty field.
SET APNPWD	password	1234 set apnpwd „“	GPRS password sets as empty field.
!VERSION		1234 !version	Detail information about device(name, serial number, fw etc.).
IUPDATE		1234 !update	Command for downloading new fw from GPRS server SEA spol. s r.o.; GPRS must be enabled on SIM card.
IFACTORY		1234 !factory	Delete current configuration and set device to factory configuration. Who send valid SMS e.g. 1234 state will be user.

15. Instruction for working with modbus elements

Implementation of modbus commands in GSM-MODBUS v2.0.25

Because some modbus devices use more than 10,000 elements, SeaConfigurator uses a 6-local system. When entering an element number in a 5-digit system, a zero will be inserted between the group number and the element number. Example 32222 will be converted to 302222.

Element	Group	Modbus Index	Modbus description	READ	WRITE
Digital outputs	Y	000001 .. 065536	coil (1bit r/w)	-	FUN05
Digital inputs	X	000001 .. 065536	coil (1bit r/w)	FUN01	-
	X	100001 .. 165536	discrete input (1bit r)	FUN02	-
Analogue inputs	A	300001 .. 365536	input register (16bit r)	FUN04	-
	A	400001 .. 465536	holding register (16bit r/w)	FUN03	-
Analogue outputs	B	400001 .. 465536	holding register (16bit r/w)	-	FUN06

PLC FATEK

If you connect a FATEK PLC to GSM-MODBUS, you can enter the element designation according to the FATEK definition directly in the field for entering the element number. SeaConfigurator automatically converts the FATEK designation to modbus registers in a 6-digit system.

Example: If you need to control output Y0 on FATEK, enter Y0 in the Outputs tab. SeaConfigurator converts the designation to modbus designation 000001.

If you need to monitor the X0 output on FATEK, enter X0 in the Inputs tab. SeaConfigurator converts the designation to modbus designation 001001.

Number of element modbus	Name of element via FATEK specification
000001~000256	Y0~Y255 Discrete Output
001001~001256	X0~X255 Discrete Input
002001~004002	M0~M2001 Discrete M Relay
006001~007000	S0~S999 Discrete S Relay
009001~009256	T0~T255 Status of T0~T255
009501~009756	C0~C255 Status of C0~C255
400001~404168	R0~R4167 Holding Register
405001~405999	R5000~R5998 Holding Register or ROR
406001~408999	D0~D2998 Data Register
409001~409256	T0~T255 Current Value of T0~T255
409501~409700	C0~C199 Current Value of C0~C199(16-bit)
409701~409812	C200~C255 Current Value of C200~C255(32-bit)

Supported macros in outgoing SMS

They are entered in the event texts in the SeaConfigurator and are used to create individual status reports. They are therefore used where the connection of a complete status report is not suitable. The STATUS message can be disabled in the SeaConfigurator on the Settings / Station settings / STATUS message tab.

[X10].....The NAME = STATUS is inserted into the SMS message instead of the macro
 [X10N] => name
 [X10V] => state
 [Y...] ... similar as [X...]
 [A...] ... similar as [X...]
 [TIME] ... actual date and time of GSM modem, example "2015-02-26 13:47:51"
 [GSMSIGNALV] or [SIG] ... strength of signal in percentage
 [STATE] ... generate whole status message

Example: Boiler=service