GSM-1 User Manual

rev. 1.10

applies to GSM-1 v3.0, v3.1 and v3.2
use CyPro 2.6.0 or later

cybrotech

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Overview

GSM-1 is GSM/GPRS module for CyBro-2. Basic functions are:

SMS
- read and write CyBro variables
- send SMS when a variable is set

Voice
- call module to perform an action
- perform call when condition is satisfied

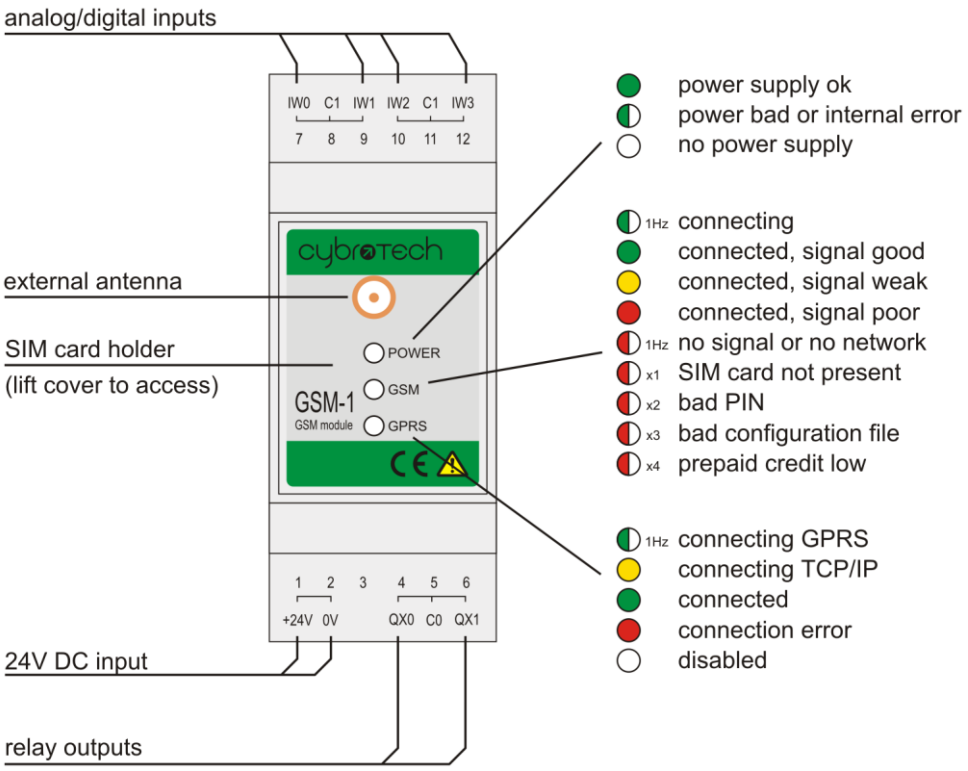
GPRS
- remote programming and monitoring with CyPro
- remote data transfer with CyBro OPC server

GSM-1 connects to IEX bus, together with other i/o modules. CyBro serial port is not used.
To use GSM-1, no programming is needed. Set a few configuration options, and module is ready.

Hardware:

- three-band 900/1800/1900MHz
- internal GSM antenna
- external antenna connector (SMA type), automatic switch
- 4 analog/digital inputs
- 2 relay outputs

Unlike other IEX modules, only a single GSM-1 can be connected to CyBro.

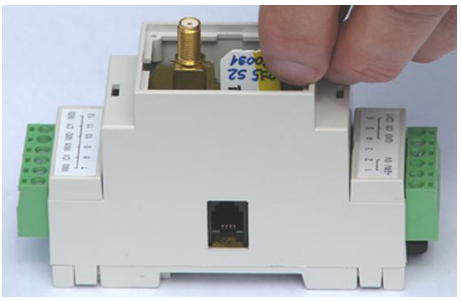


For a different product versions, please check "Versions and upgrade" chapter.

Quick setup

1. Insert SIM

Open front cover and insert SIM in card holder.



2. Edit configuration file

Edit configuration file (CyPro/Examples/GsmIniDemo.ini) according to your data:

Common

If your SIM card asks for a PIN, uncomment SimPin and enter correct PIN number.

```
[GSM]
SimPin=1234
```

Voice

Enter your mobile phone number in OutgoingPhones group.

```
[OutgoingPhones]
+385919146308
```

GPRS

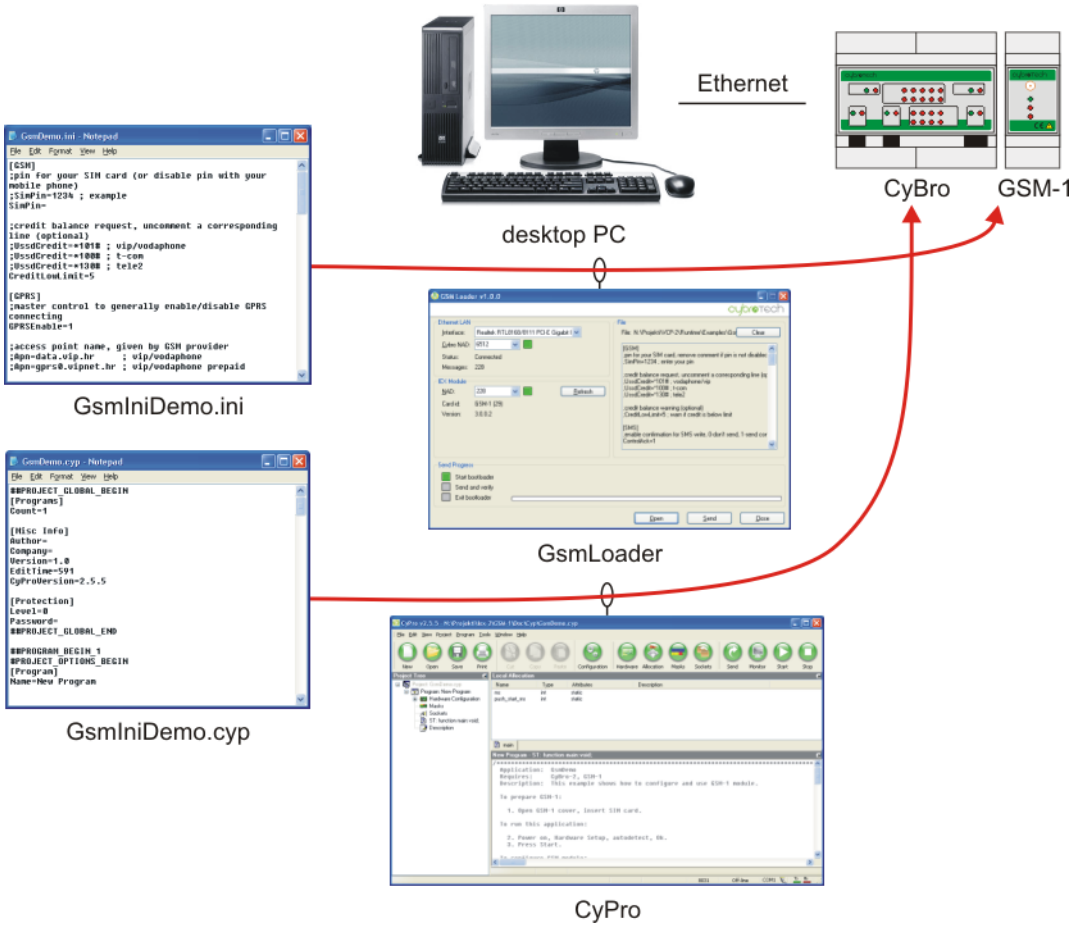
- Make sure that SIM card is data-enabled, ask your GSM provider for details.
- Set Apn, UserId, Password and DnsIp according to data provided by your GSM provider.
- Set NAD to network address of your CyBro. Use serial number, not alias.
- Set PushIp to IP address (or domain name) where push message should be sent.

```
[GPRS]
Apn=data.vip.hr
UserId=38591
Password=38591
DnsIp=212.91.97.3

[Push]
NAD=8031
PushIp=myhome.getmyip.com
```

3. Send configuration file

- Connect CyBro, GSM-1, power supply and ethernet.
- Start GsmLoader, select CyBro and GSM-1.
- Open and send GsmIniDemo.ini.
- Close GsmLoader (don't skip this).
- Start CyPro.
- Open GsmIniDemo.cyp, autodetect and start.



After transfer is complete, module will reset automatically. Minute or two later, it will connect to network, and both GSM and GPRS LEDs will be green. If configuration file has errors, GSM LED will blink.

4. Check operation

SMS

Send SMS "cybro_qx02=1" to GSM-1.

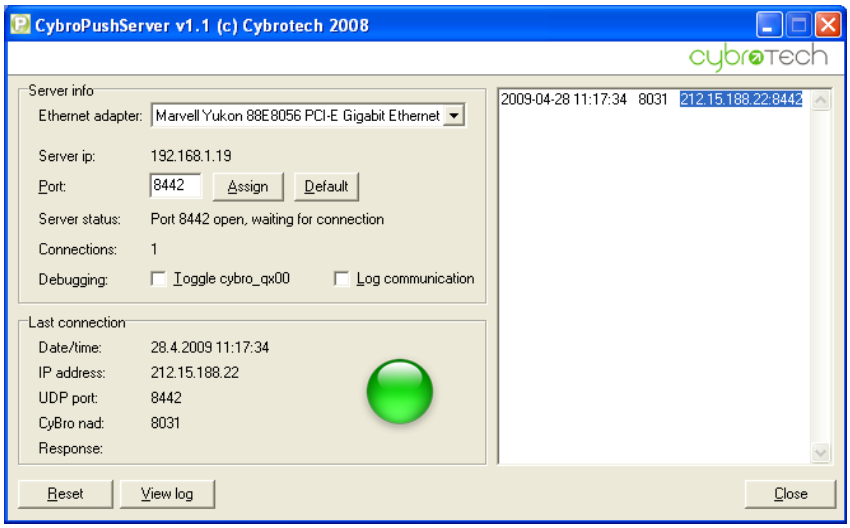
In a few seconds, relay will turn on. Confirmation message (if configured) will be received soon.

Voice

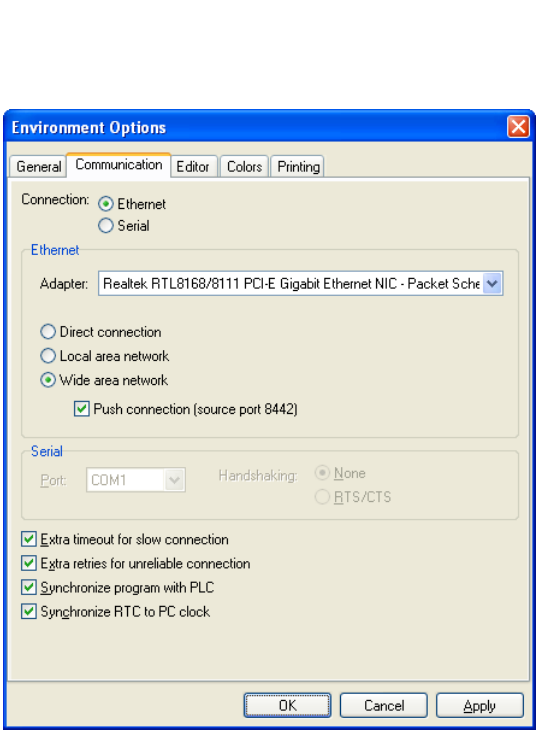
- Open variable monitor.
- Call GSM-1 from your mobile phone.
- Variable gsm_incoming_call becomes 1, and gsm_incoming_rings increments on each ring. Calling number will be displayed in array of variables incoming_number.
- Set gsm_outgoing_index to 0 and gsm_outgoing_call_req to 1 (will reset automatically). Your phone will ring.

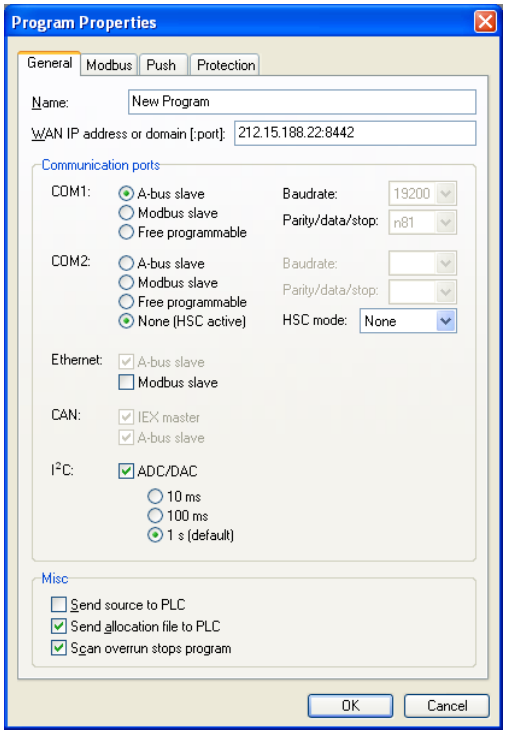
GPRS

- Make sure GSM module is configured to your WAN address (check http://www.whatismyip.com).
- Configure router to forward UDP port 8442 to your PC.
- Start CyBroPushServer, wait until push message appears.



- Remember CyBro IP address and port number, and close CyBroPushServer (don't skip this).
- Start CyPro, open GsmIniDemo.cyp.
- Configure communication for WAN, using push connection. Turn on Extra retries for unreliable connection. You may also need Extra timeout for slow connection.
- Open Configuration and enter IP address and port number from push server.

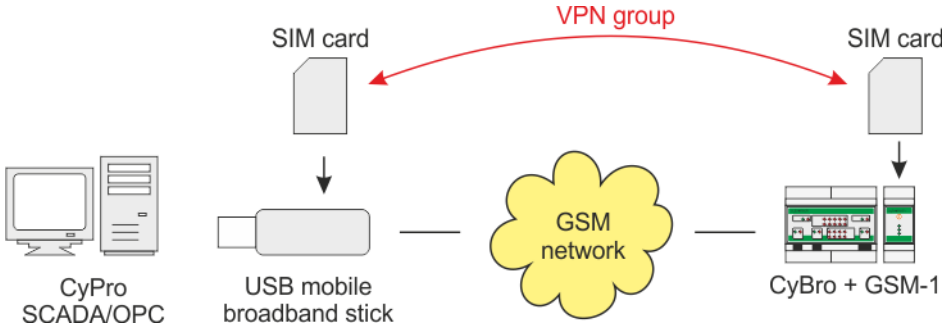




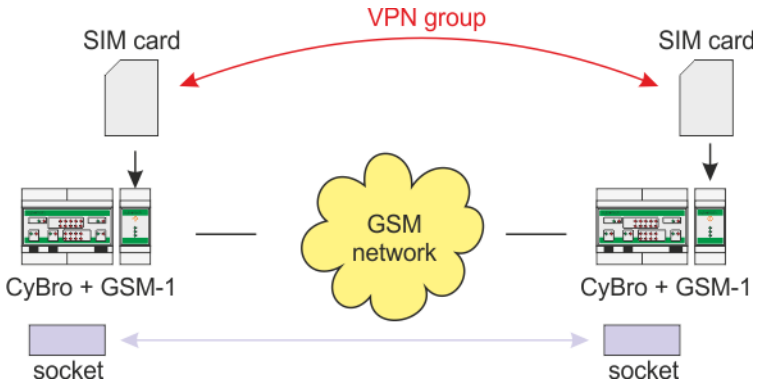
Status bar will show when communication is established.

Connection options

1. PC-CyBro using VPN SIM cards

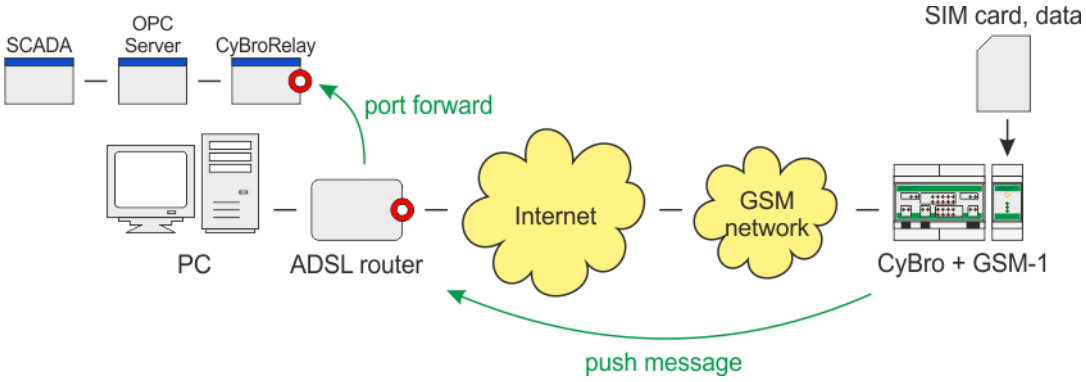


2. CyBro-CyBro using VPN SIM cards (UDP broadcast support is required)



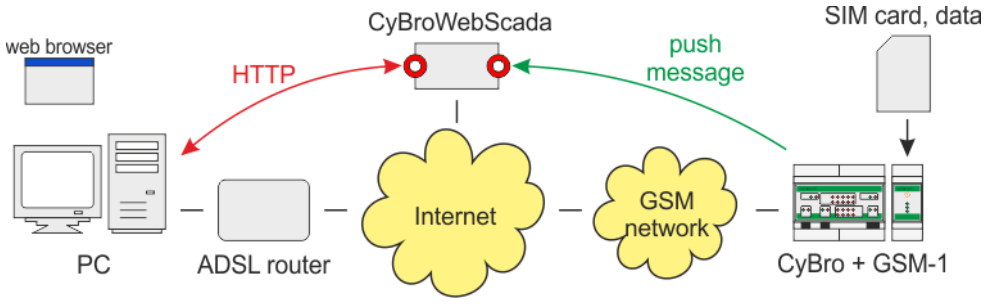
Note: VPN should be configured to pass broadcast messages.

3. PC-CyBro using Internet connection



Note: Symbol ⭕ represent a known address, static IP or dynamic DNS.

4. PC-CyBro and Web-CyBro using CyBroWebCms



Configuration

Description

GSM-1 is configured by sending configuration ini file. Use text editor to edit, and GsmLoader to send file. Configuration depends on plc program. When allocation is modified, configuration file should be updated.

Parameters are divided by groups. The group name appears in square brackets ([ ]). Semicolon (;) is used to comment a line. Comment continue to the end of the line, everything between semicolon and end of line is ignored.

Maximum size of configuration file is 14Kb. Special or national characters are not allowed, and may cause parsing error.

Configuration file

Common

```
[GSM]
SimPin=1234
UssdCredit= *101#
CreditLowLimit=5
```

SimPin is needed if PIN of your SIM card is not disabled.

UssdCredit is string for checking credit limit, defined by gsm operator. Below CreditLowLimit GSM led will begin blinking. Credit is asked once per hour. If UssdCredit doesn't exist, checking is not performed.

Note: Be aware that prepaid SIM cards have limited period of validity, expiring of which module can't detect. When in doubt, check SIM in your mobile phone.

```
[IncomingPhones]
+38591123456
+385981234567
```

IncomingPhones contains list of phone numbers (international format, beginning with '+'), allowed to call or send SMS to module. If group doesn't exist, everybody have access. If group exist, but it is empty, no one will be able to access.

```
[OutgoingPhones]
+38591123456
+385981234567
```

OutgoingPhones contains list of phone numbers (international format, beginning with '+'), which will be called (or sent SMS) in case of an alarm.

SMS read/write

```
[SMS]
;enable confirmation for SMS write, 0-don't send, 1-send confirmation
ControlAck=1
```

ControlAck tag defines weather SMS write confirmation is sent or not.

```
[CybroVars]
cybro_qx00=1024,1
cybro_iw00=2048,2
my_counter=6144,3
```

List of accessible CyBro variables. Variables are used for SMS read/write, or as a content of an alarm message. Use address from allocation file (.alc), generated by CyPro. Alc file contains hexadecimal address, so it should be converted to decimal. Variable type is 1-bit, 2-int, 3-long and 4-real.

Alarm function

```
[SMSAlarmTrigger]
1024
1025

[SMSAlarmText]
Alarm: fire in cellar! CO=%co_measured:1%
Alarm: valve %valve is broken! Pressure is %pressure:2
```

Alarm is sent when trigger variable is set to 1. Module will automatically reset variable to 0.

Voice function

```
[Voice]
;0-leave incoming call ringing, 1-hangup after first ring
RxHangup=0
```

RxHangup tag defines weather the incoming call is leave ringing or hanged up.

GPRS function

```
[GPRS]
GPRSEnable=1    ; Global control to enable or disable GPRS.
Apn=gprs0.vipnet.hr
UserId=38591
Password=38591
DnsIp=212.91.97.3
```

Apn, UserId, Password and DnsIp are provided by GSM operator.

```
[Push]
NAD=8031          ; CyBro NAD (serial number, not alias).
PushIp=89.1.3.96; IP address or domain name to which push is sent.
PushPort=8442     ; Port to which push is addressed, use 8442.
PushPeriod=60     ; Period of the push repetition in seconds.
```

Push group is used for push message. Purpose of push message is to get IP address of CyBro.

Input/output variables

Input/output

gsm_ix00..gsm_ix03 - digital inputs, 0-off, 1-on
gsm_iw00..gsm_iw03 - analog inputs, voltage 0..10V, 0..1023
gsm_qx00..gsm_qx01 - relay outputs, 0-off, 1-on

note: digital and analog inputs share same terminals

Status bits

gsm_general_error - one or more system errors occurred (timeout, program or bus error)
gsm_timeout_error - communication failed, no messages are coming from the module
gsm_program_error - internal or configuration error detected, module is not functional
gsm_bus_error - module detected a number of communication errors, but it is still working
gsm_connected - module connected to GSM network (domestic or roaming)
gsm_roaming - domestic network not found, roaming connected
gsm_gprs_connected - module connected to GPRS network

Status words

gsm_error_status - module status: b7:voice_tx_error, b6:SMS_tx_error, b5:udp_tx_error, b4:no_credit, b3:config_error, b2:PIN_error, b1:sim_error, b0:network_denied
gsm_gprs_status - status of GPRS network registration (0..7-connecting, 8-connected, 9..11-error)

Module info

gsm_signal_quality - GSM signal quality, range 0..31 (0..7 poor, 8..14 acceptable, 14..31 good)
gsm_credit_balance - credit balance in local currency for prepaid SIM card (e.g. 24 means 24EUR), checked every 60min, always zero for postpaid.

Incoming voice call and SMS

gsm_incoming_call - incoming call active, 1-ringing, 0-hangup
gsm_incoming_rings - number of incoming rings, reset when receiving a call, counting up with each ring
gsm_incoming_digit_req - set to read a single digit of incoming phone number, will reset automatically
gsm_incoming_digit_data - single number of incoming phone number
gsm_message_received - incoming message received (1-message received)
gsm_incoming_letter_req - set to read a single letter of incoming sms message, will reset automatically.
gsm_incoming_letter_data - single letter of incoming sms message

Outgoing voice call and SMS

gsm_outgoing_digit_data - single digit of phone number to write to module
gsm_outgoing_digit_req - set to write a single digit of outgoing phone to module buffer, will reset automatically
gsm_outgoing_digit_ack - acknowledge on outgoing number digit
gsm_outgoing_index - index of phone number to be called; -1 for number from cybro-defined, 0 for first number in the [OutgoingPhones] list, 1 for 2nd, 2 for 3rd...
gsm_outgoing_call_req - set to make an outgoing voice call; phone will ring until call is denied, or for maximum of 60 seconds, will reset automatically
gsm_outgoing_letter_data - single letter of sms message to write to module
gsm_outgoing_letter_req - set to write a single character of outgoing sms message to module buffer, will reset automatically
gsm_outgoing_letter_ack - acknowledge on outgoing message letter
gsm_outgoing_sms_req - set to send custom defined sms message, will reset automatically

Push message

gsm_push_message_req - request to send push message

Basic functions

SMS read/write

SMS function provides reading and writing CyBro variables.

Read commands are given as: <variable>=?
Write commands are given as: <variable>=<value>

SMS may contain multiple commands, separated by spaces. Mix of reading and writing is supported.

If reading succeeds, read value is returned. If writing succeeds, read value and 'ok' is returned (only when ControlAck is 1). If reading/writing fails (e.g. wrong name), err is returned.

Module first perform writes, then reads. Result is always an actual CyBro value.

Read variable:

```
send:  a=?
reply: a=5
error: a=err
```

Write variable:

```
send:  a=5
reply: a=5 ok
error: a=err
```

Multiple reads and writes:

```
send:  a=? b=22 c=? d=35
reply: a=11 b=22 ok c=err d=30 ok
```

In this example, variable c doesn't exist and variable d is limited by CyBro program. If messaging is not working, it may be because SIM card is data-only.

Alarm function

When trigger variable is set to 1, related SMS will be sent. After getting request, module will automatically write 0 to trigger variable.

Triggers, messages and phone numbers are located in separate groups:

```
[SMSAlarmTrigger]
1024
1025

[SMSAlarmText]
The quick brown fox jumps over lazy dog.
The slow brown dog jumps over lazy fox. Total jumps: %jump_count

[OutgoingPhones]
+491112345678
+491112345678
```

First trigger is related to first message/number, second trigger to second message/number and so on.

Alarm message may show values, in format %<variable name>[:<d>]. Variables should be defined in [CybroVars] group.

If <variable name> is defined, value will be sent, otherwise percent sign and following characters will be sent as text.

The number of decimal places can be specified with :<d>, where d is a single digit number. Integer variables are divided by 10 for each decimal place. Real variables are printed as-is. If the number of decimal places is not specified, floating point numbers will default to 6 decimal digits.

Note: if trigger variable is permanently forced to 1 by CyBro program, GSM-1 will send SMS messages repeatedly.

Incoming voice call

When incoming call is received, variable gsm_incoming_call is set. When call is ended, variable will reset automatically. Variable gsm_incoming_rings is incremented on each ring. It will retain value until next call, then it will restart with first ring. In consequence, it will never again reach zero.

If RxHangup in Voice group is set, call is rejected after the first ring.

If voice call is not working, it may be because SIM card is data-only.

Outgoing voice call

Outgoing voice call on numbers defined in [OutgoingNumbers] can be activated by CyBro program as follows:

- write phone number index to gsm_outgoing_index
- set gsm_outgoing_call_req to 1

Phone will ring until call is denied, or for maximum of 60 seconds. Will reset automatically.

If voice call is not working, it's possible that your SIM card is data-only, with no voice capabilities.

Working with plc program

Note: this section applies to GSM-1 v3.1 only.

CyBro program has complete control on voice calls and SMS, both received and sent.

An example for such operation is GsmPlcDemo.cyp. Interface functionality is given in VoiceAndSMSAPI. To use in your application, copy/paste all functions and variables.

Incoming SMS

Negative flank of variable incoming_message_reading indicates that SMS is received. Message content and sender number are available in incoming_message and incoming_number. CyBro will receive all messages, including those already handled by module.

Outgoing SMS

To send a SMS, write text to outgoing _message and phone number to outgoing_number, then set send_message to 1 (will reset automatically).

Incoming voice calls

On incoming call variable gsm_incoming_call becomes 1, and gsm_incoming_rings increments on each ring. Negative flank of variable incoming_number_reading indicates that number is available in incoming_number.

Outgoing voice calls

To make a voice call, write phone number to outgoing_number and set outgoing_call to 1 (will reset automatically). Call will last until denied on receiving phone, or for a maximum of 60 seconds.

VoiceAndSMSAPI variables

Interface

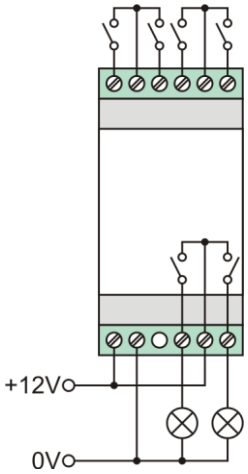
incoming_number[20] – buffer for incoming phone number, ASCII, zero terminated
incoming_number_reading – flag indicating reading of incoming number
incoming_message[160] – buffer for incoming message content, ASCII, zero terminated
incoming_message_reading – flag indicating reading of incoming message
outgoing_number[20] – buffer for outgoing phone number, ASCII, zero terminated
outgoing_call – set to make a call
outgoing_message[160] – buffer for outgoing message content, ASCII, zero terminated
send_message – set to send an sms

Local

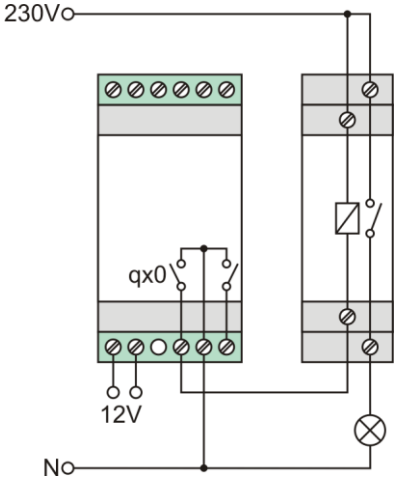
incoming_number_size – number of incoming phone digits
incoming_message_size – number of letters in incoming message
number_write_index – index of currently writing outgoing number
outgoing_number_writing – flag indicating writing of outgoing number
sms_write_index – index of currently writing outgoing sms letter
outgoing_message_writing – flag indicating writing of outgoing sms message

Wiring schematics

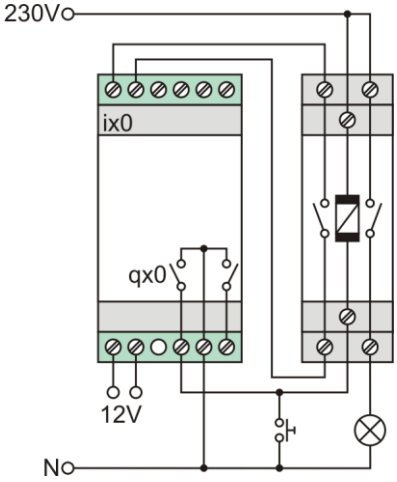
Digital inputs, 24V output



Output using 230V contactor



Output using 230V bistable relay



Technical specifications

GSM module	three-band 900/1800/1900MHz
GPRS class	mobile station class B
Antenna	internal or external
Connector	SMA with automatic switch
External antenna	50ohm nominal
Input type	digital / analog 0..10V
Internal pull-up	12V, 2mA
A/D converter	10-bit
Analog readout	0..1023
Accuracy	5% FSR at 25°C
Update time	5ms typ.
Output type	relay contact, normally open
Load	max. 3A/250V AC or 3A/30V DC, resistive
Update time	5ms typ.
Power supply	24V DC (18-26V)
Power consumption	75mA standby, 100mA active
Operating conditions	0..50°C, 0..85% rh non-condensing
Dimensions	36x99x70mm

For a stand-alone operation, connect power supply to +24V and GND terminals.

Mounting

When operating on internal antenna, it is recommended to mount GSM-1 away from CyBro and other modules. Placing at top of cabinet will provide a better signal, resulting in more stable communication.

Class B operation

Mobile station class B can connect to both GSM and GPRS, but only one connection may be used at a time. During GSM service (voice call or SMS), GPRS is suspended, then resumed automatically after the GSM is concluded. The consequences are:
- receiving SMS is postponed and voice calls are blocked while GPRS is active (outgoing SMS is not affected)
- remote GPRS connection is not possible while voce call is active

LED signalization

POWER
on - module is connected to 24V power supply
blinking - unstable power supply or internal error
off - no power supply

GSM
green blinking, 1 per second - connecting
green - registered to domestic GSM network, good signal quality
yellow - registered to domestic GSM network, acceptable signal quality
red - registered to domestic GSM network, poor signal quality
Short off every 2 seconds (green, yellow or red) means roaming.
red, 1 blink per second - not registered, no signal or no network
red, 1 short blink in 2 seconds - SIM card not present
red, 2 short blinks in 2 seconds - bad PIN
red, 3 short blinks in 2 seconds - bad configuration file
red, 4 short blinks in 2 seconds - credit low

GPRS
green blinking, 1 per second - connecting
yellow - GPRS connected, TCP/IP connecting
green - GPRS and TCP/IP connected
red - disconnected, will try to connect again
off - no connection, GPRS disabled

Versions and upgrade

Released versions:

hardware code	firmware version	cypro version	applicable demo
GSM-1 v1.1	v3.0	v2.5.6 and later	GsmIniDemo.cyp
GSM-1 v1.1	v3.1	v2.5.8 and later	GsmIniDemo.cyp GsmPlcDemo.cyp
GSM-1 v1.1	v3.2	v2.6.2 and later	GsmIniDemo.cyp GsmPlcDemo.cyp

As hardware for all versions is same, each module can be upgraded to latest firmware. Upgrade options are:

upgrade option	hardware needed	software needed	remark
upgrade over CAN bus	P-CAN adapter	IEX-loader v2.0.3	safe method
upgrade over Ethernet	CyBro v2.5.6 and later	IEX-loader v3.0.0b	experimental
send to service	-	-	small fee may be applied

Change history:

firmware version	deleted	added
v3.0	-	-
v3.1	incoming number visible directly	phone number and sms content accessible from plc program, check GsmPlcDemo
v3.2	-	option to reset module from plc program

Plc program written for v3.0 will work with v3.1 and v3.2, except if it use variables to directly display received phone number. In such case, program should be adjusted to method used in GsmPlcDemo.

Plc program written for v3.1 will work with v3.2 without any changes.

Backward compatibility is not retained.

We recommend using the latest software revision whenever possible.