Sendyne®

SIM101 Maintenance Mode

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REVISION INFORMATION

Revision	Date	Description
1.0	03/21/2019	Initial version

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1. Introduction

The SIM101 firmware introduces a maintenance mode which provides the ability to configure the following parameters of the device:

- CAN2.0B identifiers used for communication,
- CAN communication speed (250 or 500 kbits/s),
- system maximum working voltage,
- isolation warning and fault thresholds.

The maintenance mode is only accessible within a specific time window after powering up the SIM101 and requires a specific sequence of messages to be unlocked.

2. Maintenance mode

The SIM101 maintenance mode overall workflow is shown in Figure 1. The following timing restrictions apply:

- The unlock request to enter the maintenance mode must be sent within 10 seconds after powering up or resetting the SIM101 device.
- The challenge answer must be received within 2 seconds after the challenge has been sent.
- Once the maintenance mode has been unlocked, a message must be received by the SIM101 device every two seconds or less. Otherwise the SIM101 will reset without changing its configuration.

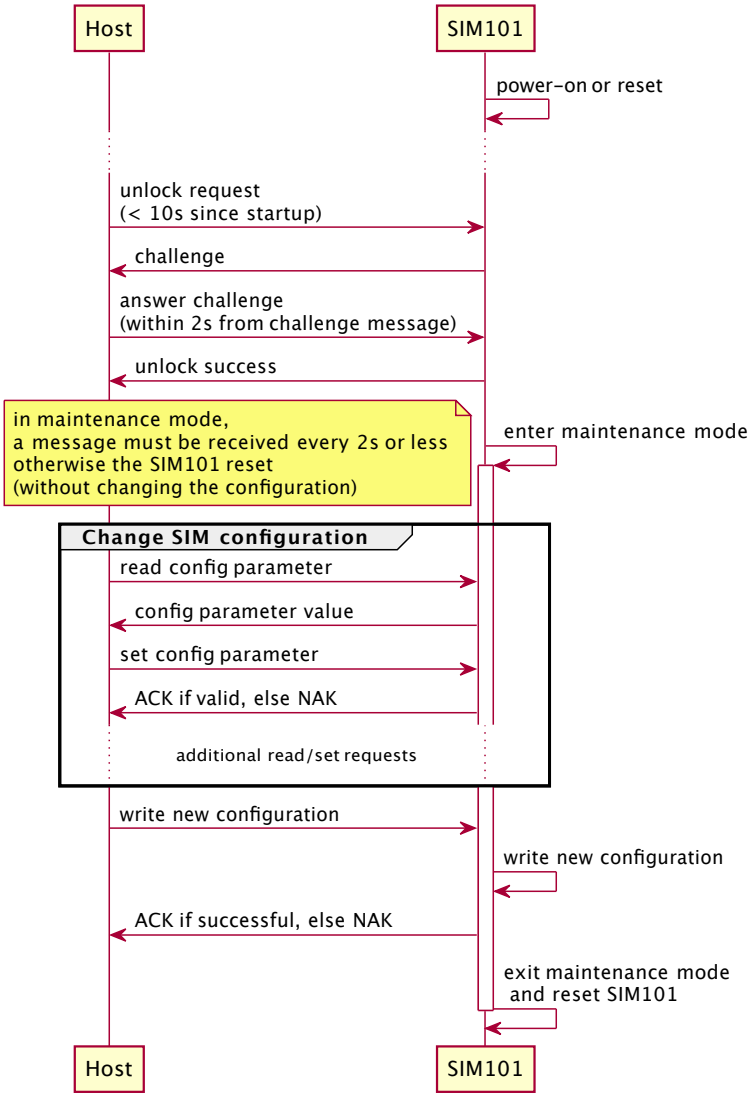

Figure 1: SIM101 maintenance mode workflow overview.

Note that the CAN communication will use the CAN identifiers currently programmed in the SIM101.

The ACK (acknowledge) and NAK (not acknowledge) messages used during maintenance mode communication are defined in Table 1.

Message	Byte 0	Byte 1	Byte 2
ACK	0x41	0x43	0x4B
NAK	0x4E	041	0x4B

Table 1: SIM101 maintenance mode ACK and NAK messages.

2.1. Unlock sequence

In order to unlock the maintenance mode ,the unlock request message shown in Table 2 must be sent to the SIM101 device.

Message	Byte 0	Byte 1	Byte 2
Unlock Request	0x14	0x28	0xD5

Table 2: SIM101 maintenance mode unlock request message.

The SIM101 device will reply with:

- a NAK message if the unlock request time window has expired,
- a challenge message if the unlock request was received within the 10 seconds time window (see Figure 1).

If the unlock request time window has expired, the SIM101 device must be power-cycled or reset in order to unlock the maintenance mode

The challenge message is a CAN frame containing 8 data bytes: the first byte is always 0x14 and the remaining 7 bytes are based on the device serial number. This challenge message must be followed by the challenge answer within 2 seconds. The challenge answer message must be a 8 bytes CAN frame where: the first byte is 0x14 and the remaining 7 bytes are calculated by xoring (exclusive OR) the challenge message last 7 bytes with the value 0x534E4453494D42. An example of challenge message and answer message is shown in Table 3.

Message	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Challenge example	0x14	0x01	0x23	0x45	0x67	0x89	0xAB	0xCD
Challenge answer	0x14	0x52	0x64	0x01	0x34	0xC0	0xE6	0x8F

Table 3: SIM101 maintenance mode challenge example.

If the challenge answer is received within 2 seconds from the challenge, then the SIM101 device will reply with an ACK message and enter the maintenance mode. If the challenge answer is incorrect or received too late, the SIM101 device will reply with a NAK message.

Once the device enters the maintenance mode, a CAN message must be received every 2 seconds, otherwise the device will exit maintenance mode without changing its configuration and reset.

2.2. Configuration commands

Once the device is in the maintenance mode the host can read or set the configuration parameters of the SIM101.

- Read requests must be sent as CAN messages with DLC=1 and the single data byte must be one of the values listed in Table 4.
- Set request must be sent as CAN messages with 5 data bytes: the first byte must be one of the values listed in Table 4 and the last 4 bytes must encode the configuration value as a big endian 32-bit integer.

Note that the CAN communication speed parameter is encoded as follows:

- 250 kbit/s is represented by the value 0x00CA0250,
- 500 kbit/s is represented by the value 0x00CA0500.

Parameter	Byte 0 code	Remarks
CAN RX identifier	0x15	Must be a valid CAN2.0B (29 bit wide)
CAN TX identifier	0x16	Must be a valid CAN2.0B (29 bit wide)
CAN communication speed	0x17	Must be one of the supported values
Maximum working voltage	0x18	Must be a positive value in Volt less than module voltage rating
Isolation warning level	0x19	Must be a positive value in Ohm/V
Isolation fault level	0x20	Must be a positive value in Ohm/V

Table 4: SIM101 maintenance mode configuration parameters.

When setting a configuration parameter the SIM101 device will reply with an ACK message if the value is accepted and a NAK message if the value is rejected.

2.3. Finalizing configuration

After modifying the configuration of the SIM101 device, the new configuration must be finalized and written to the device. This is performed by sending the *commit configuration* message shown in Table 5.

Message	Byte 0	Byte 1	Byte 2
Commit config.	0x14	0x9A	0x28

Table 5: SIM101 maintenance mode commit configuration message.

Once that message is received by the SIM101 device, the new configuration will be written to the non-volatile memory and an ACK message will be sent. If the write operation fails, a NAK message will be sent. Finally, the SIM101 device will reset and the new configuration will be in effect.

3. Code example

This document contains as attachments a small C library (one header file and one implementation file) that implements several functions to deal with the maintenance mode:

- the function `SIM101_unlock_maintenance_mode` must be used to unlock the maintenance mode,
- the functions `SIM101_read_configuration` and `SIM101_set_configuration` can be used to read and set the SIM101 device configuration once the maintenance mode has been unlocked.

4. Hardware reset to default configuration

It is possible to perform a hardware reset of the SIM101 device to restore a default configuration.

The values of the parameters in the default configuration are given in Table 6.

Parameter	Value
CAN RX identifier	0x0A100101
CAN TX identifier	0x0A100100
CAN communication speed	500 kbit/s
Maximum working voltage	0 V
Isolation warning threshold	500 Ohm/V
Isolation fault threshold	100 Ohm/V

Table 6: SIM101 maintenance mode configuration parameters.

To restore the default configuration performs follow these steps:

1. Unpower the device and disconnect all inputs.
2. Connect pins 1 and 2 of the SIM101 IC to the ground of the device.
3. Power the device and wait 10 seconds.
4. Unpower the device.
5. Remove the connection between pins 1 and 2 of the SIM101 IC and the ground of the device.

After following this sequence the SIM101 device will be operating with the default configuration.