

Gate-Control software

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1.Document history

Version	Date	Description
1.0	Dec 22, 2025	Initial document

2.Requirements

A **SIM card without PinCode** is required (this can be done with a smartphone).

The **SIM must be properly initialized**, this is usually done by inserting the SIM into a smartphone and doing a first call over the mobile network (eg : Belgium).

Only after, the SIM can be inserted within the **gate-control** to power it on and start the configuration.

3.Quick tour

The gate-control project uses a 4G [Base Station kit](#).

4G Base Station

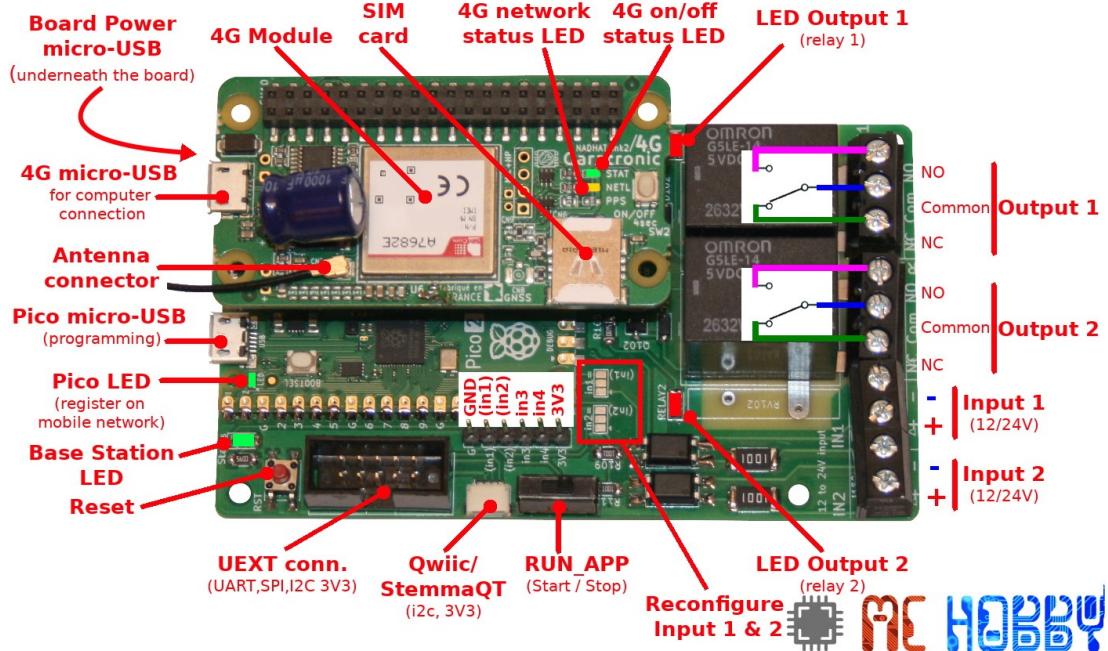


Fig : features of the 4G Base station board.

The key features of the board are :

- 2x relay output** : this galvanic isolation allow to control high power devices. By design this output can be used up to 24V DC or 48V AC.
- 2x opto-isolated input** : able to read 12V / 24V input signal.
- 2x 3,3V input** : for extra application

- **1x UEXT port** : exposing a SPI bus, I2C bus UART and 3,3V power for custom application
- **1x Qwiic/StemmaQt port** : exposing 3V3 I2C to connect i2C board/sensor for custom application
- **Pico Powered** : powered with Raspberry-Pi Pico 2 microcontroller.
- **MicroPython Powered** : this solution is written in python. The code can be tuned to your need. See the technical documentation to schematic and details.
- **5V Powered** : the entire project runs with 5V micro-USB power supply.



The relays are able to handle grid power switching. The board also have location to solder varistor (transient effect suppressor) coupled to the relays. The relay traces (copper, 3,5mm wide) will allow substantial power switching. All-in-All this board could withstand higher voltage handling but it is not intended to by design! If you do so, it is at your own risk.

4.Quick Setup

Insert the **configured** SIM card into the 4G board.

Power-up the board on the **board power micro-USB**.

After few seconds, the base station LED will flash quickly. It is the factory state, the gate-control without **master** phone registered. See *Reset configuration* if necessary.

Use your mobile phone and call the gate-control. The phone call will be accepted and immediately terminated.

Your phone number is now the **master**. The base station LED will now pulse every 3 seconds signaling the normal operation.

From now, the master user can :

- call the gate-control to activates the output 1.
- send the « OUT2 » sms to activates the output 2.
- send configuration sms to gate-control (see *Parameters* for more informations).

5.Factory reset

In the factory configuration, no master user is defined yet and the gate-control LED does flash quickly (several times each second).

5.1.Reset configuration

The **gate-control** can be resets to its factory configuration.

Follow the steps below to reset the configuration :

- 1.Remove the power from the board.
- 2.Place the RUN_APP switch in STOP position
- 3.Connect the IN4 to 3,3V with a jumper
- 4.Connect the IN3 to GND with another jumper
- 5.Power the board (through its micro-USB power)

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The board will starts and will reset the configuration within a second. When done, the Pico LED lit for 2 seconds then goes out. The board configuration is now reset.

5.2.After reset steps

- 1.Power-off the board
- 2.Remove the jumpers connecting IN3 & IN4
- 3.Switch the RUN_APP switch to RUN position
- 4.Power-up the board

The software starts with the factory configuration (so without master user). The gate-control LED must flash quickly.

6.Status LEDs

6.1.Pico LED

The LED on the Raspberry-Pi Pico (next to its USB connector) will **lit when the board gets registered on a mobile network..**

Note : the Base Station LED will lit (fixed) while powering-up the 4G module THEN pulse at 500ms while registering the mobile network.

6.2.4G module LEDs

The 4G module fits 3 status LEDs :

- STAT (green)** : Powered and internal initialization completed
- NETL (orange)** :
 - Fixed = not registered on network
 - 2 blink/sec = registered on network
- PPS (blue)** : -to be defined-

Note : 4G module can be power-off by pressing the on/off button for 5 seconds then release it.

6.3.Base Station LED

The base station LED can use multiples modes to communicates about the software state.

- Heartbeat** : just a short blink every Nth seconds. The time is a useful information.
- Pulsing** : where the LED progressively light-up then progressively light down. The time for a full cycle is a useful information.
- Blinking** : where lit time is identical to off time. Blinking is usually more or less fast. The time a of a full cycle is a useful information
- Error** : series of fast blinking followed by a given number of slow blinks (this is the numerical error code).

Mode	Information	Description
Pulse	3sec/pulse	Slow pulse indicates processing of the main loop.
Fixe + Pulse	Fix ~10 sec + 500ms	Power-up 4G and connecting to mobile network. The status LED is ON while powering-up the 4G module and training the UART. Note : Pico LED will lit when registered !
Blink	~4x/sec	Very fast blink after power up signal a master phone number not yet registered. First call will become the master phone number.
Error	2	Cannot connect mobile network. See REPL output on Pico MicroUSB for more details.
Error	3	Unexpected error in treatment loop. See REPL output for more details

7.Output control

The board is fitted with 2 outputs (namely Output 1 and Output 2), each one controlling a relay. Each relay offers a normally open and normally close contact.

The control of the Outputs (the relays) are straightforward.

- The user call and the Output 1 (relay) get activated.
- The user send a SMS and the Output 2 (relay) get activated.

Behind the basic features, outputs also take care of the following :

- The **user must be allowed** to do so (see *User rules and rights* section).
- The **admin is notified** of the opening (see *User rules and rights* section).
- The Output **pulse time or toggle** can be tuned (see *Parameters* section).
- The Output 1 can also be controlled with SMS (see *Parameters* section).

8.Input control

The board is fitted with 2 opto-isolated 12~24V input (IN1 and IN2) as well as 2 additional 3,3V inputs (IN3 and IN4).

 Opto-coupled entries have also been tested under 5V and looks to work properly.

Signal on input is used to trigger alarm. Alarm is used to trigger notifications to user.

The **input control uses a state machine to avoids continuous notification sending** on event. Indeed, you do not want to get a SMS message every 5 seconds

when the temperature of the fridge raise over 10°C. A message every 15 minutes is quite enough.

In the same spirit, you may not want to be get a SMS each time the fridge is open but want to get alerted when the door stays open more than 60 seconds!

The state machine uses 4 states:

- **Off** : The read signal is not the source of alarm.
- **Observation** : The read signal is the source for alarm. If its presence time on the input pin do not reach the observation time then the state remain as Observation ! (eg : signal should be present at least 10 seconds)
- **Alarm** : The state when the alarm is raised (and notifications sent) just before getting the transition to Idle state.
- **Idle** : After the alarm, the Idle time starts (in minutes). The input signal is ignored during idle time and avoids notification cascade. Idle time may be incompressible or may exits when the input signal resets (see the `irst` parameter).

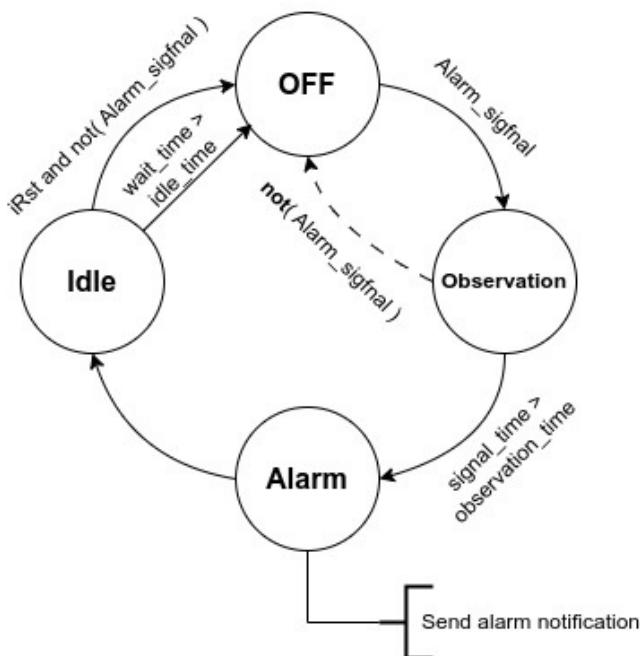


Fig : state machine for input

What are the parameters controlling the state machine :

- Input mode
- Observation time
- Idle time
- Idle reset



Modifying the alarm parameters requires a save operation followed by a platform restart (reboot) to load the new set of parameters.

8.1.mode

The mode indicates if the alarm signal is detected for a High or a Low level signal.

Input IN1 and IN2 (12V/24V compatible) do have pull down resistor so alarm signal will be detected for a High level.

Input IN3 and IN4 (3,3V compatible) are floating input. Alarm signal can then be configured for detecting a High or Low signal.

See parameter `in1-mode` in *Parameter list* for more information.

8.2.Observation time

The observation time is the number of consecutive **seconds** of signal detection. When this happens then the alarm state is trigger.

See parameter `in1-obs` in *Parameter list* for more information.

8.3.Idle time

After the alarm, the signal is not checked during the **minutes** of the idle time period.

See parameter `in1-idl` in *Parameter list* for more information.

8.4.Idle reset

The idle period can be shorten when the alarm signal fallback to its original state. It is the aim of the « idle reset » parameter.

When activated, the idle time period is shorten with the signal fallback.

When deactivated, the idle time period always runs to its end.

See parameter `in1-irst` in *Parameter list* for more information.

8.5.Alarm notification

The alarm notification are usually sent **via SMS**. Several users can be notified from a single alarm.

The alarm could also trigger a **phone call** (a single phone call to a single user).

This feature is controled by the `in1-ntyp` to `in4-ntyp` parameters (see *Parameter list* for more information).

 *Notifying via phone call is also relying on a user action. This may lead to unexpected behavior (eg : user accepting phone call then never terminate it).*

9.User rules and rights

9.1.Type of user

All users are identified by their international phone number (eg : +32477668811).

It exist 3 type of users :

- Master** : the phone number **having all rights** ! It can add/configure the board with SMS add new admins and new users. Master also **gets all the notifications** by defaults. The master can add/remove admins & users as well as modify the rights of any users. Notice that master will also be informed of any denied/error attempt on the gate-control.

- Admins** : the phone numbers having the right to modify their own config (except ADD_USER right) and the configuration of users. Admins can also add/remove

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users when its ADD_USER right is added to them. Admins also gets all the notifications by default.

•**Users** : the users are added/removed by the Master or the Admins (having the ADD_USER right). By default, they only have the « CAN_OUT1 » right used to open the gate when calling the gate-control. User right can be altered by Admins or Master (eg : to activates the second relay with SMS or to get notifications).

9.2.The rights

What master / admins / users can do is governed by rights. Here a list of rights code, short code and description.

Code	Short	Description
ADD_USER	AU	Can add/remove users or admins
NOTIF_IN1	I1	Get notification SMS on IN1
NOTIF_IN2	I2	Get notification SMS on IN3
NOTIF_IN3	I3	Get notification SMS on IN3
NOTIF_IN4	I4	Get notification SMS on IN4
NOTIF_OUT1	O1	Get notification SMS on OUT1 activation
NOTIF_OUT2	O2	Get notification SMS on OUT2 activation
CAN_OUT1	C1	Can activate OUT1 (with phone call)
CAN_OUT2	C2	Can activate OUT2 (with SMS)

10.Parameters

The behaviors of the Gate-Control can be tuned by setting parameters. Parameters cover messages, notification text, output configuration, input configuration.

The parameters are set and check with the Pset and Plist SMS messages (see Configuration SMS section).

► *There is no enforcement checks on parameter value when they are modified. User should modify the value with care.*

► *The alarm parameters modification requires the gate-control to restart for the configuration to get applied.*

10.1.Valid value

A valid parameter value is either:

- an integer (when it applies)

- a text string with limited character sett (see table below)

32	48 0	64 @	80 P	112 p
33 !	49 1	65 A	81 Q	97 a
	50 2	66 B	82 R	98 b
35 #	51 3	67 C	83 S	99 c
	52 4	68 D	84 T	100 d
	53 5	69 E	85 U	101 e
	54 6	70 F	86 V	102 f
	55 7	71 G	87 W	103 g
	56 8	72 H	88 X	104 h
	57 9	73 I	89 Y	105 i
	58 :	74 J	90 Z	106 j
43 +	59 ;	75 K		107 k
	60 <	76 L		108 l
45 -	61 =	77 M		109 m
46 .	62 >	78 N		110 n
	63 ?	79 O		111 o

Fig: List of characters allowed in a text string

10.2.Parameter list

The gate-control behaviors can be tuned by adjusting parameters.

Parameter	Type	Description
poweron-label	Text	Text send to the master when the base-station starts. Default value : Starting
out1-label	Text	Notification label send to users having the NOTIF_OUT1 right. The notification is sent when the Output 1 is activated. Default value : OUT1 activated
out2-label	Text	Notification label send to users having the NOTIF_OUT2 right. The notification is sent when the Output 2 is activated. Default value : OUT2 activated
in1-label	Text	Notification label send to users having the NOTIF_IN1 right. The notification is sent when the Input 1 is activated. Defaultt value : IN1 activated!
in2-label	Text	Notification label send to users having the NOTIF_IN2 right. Defaultt value : IN2 activated!
in3-label	Text	Notification label send to users having the NOTIF_IN3 right. Defaultt value : IN3 activated!
in4-label	Text	Notification label send to users having the NOTIF_IN4

		right. Defaultt value : IN4 activated!
Output control		
out1-cmd	Text	Allow SMS command to activate the Output 1 (Output 1 is also activated with phone call) Defaultt value : OUT1
out1-mode	Text	Indicates how the Output 1 acts. - Pulse mode : the output turn-on then turn-off after few seconds. - Toggle mode : change output state at each call. Defaultt value : P
out1-sec	Integer	Seconds between the turn-on then turn-off when the output acts in Pulse mode. Default value : 3
out2-cmd	Text	SMS command to activate the Output 2. Defaultt value : OUT2
out2-mode	Text	Indicates how the Output 2 acts (see out1-mode for details) Default value : P
out2-sec	Integer	See out1-sec for details. Default value : 3
Digital Input alarm		
in1-mode	Text	H/L/D, indicate the signal triggering the alarm(High or Low) for IN1 input. The value D is used to Deactivate the alarm detection on IN1 input. Default value : D
in1-obs	Integer	Observation time in seconds for IN1 input. Time for the signal to be continuously detected before activating the alarm and sends the alarm notification. Default value : 1
in1-idle	Integer	Idle time in minutes for IN1 input Idle time after the alarm was triggered and notified. During idle time, the input signal is not checked. After idle time, the observation time restarts if the signal is still triggering the alarm. In such case, subsequent alarm notification will be sent before starting a new idle time period. Default value : 2
int1-irst	Integer	(1/0) Idle reset for IN1 input Reset the idle time after the alarm when the signal resets (when it come back to "not alarm" state). <u>When 1:</u> a new alarm could possibly get triggered as

		<p>soon as the signal activates again the alarm whatever the value of idle time.</p> <p><u>When 0:</u> the idle time must get completed before the code get a chance to trigger a new alarm whatever the signal changes or not.</p> <p>Default value: 1</p>
int1-ntyp	Text	<p>Notification type Sms or Call.</p> <p><u>When S:</u> a SMS message is sent to all user having the NOTIF_IN1 right.</p> <p><u>When C:</u> start to call to the first notifier (only one user should have the NOTIF_IN1 right in such case).</p> <p>Default : S</p>
in2-mode in3-mode in4-mode	Text	See in1-mode definition.
in2-obs in3-obs in4-obs	Integer	See in1-obs definition
in2-idle in3-idle in4-idle	Integer	See in1-idle definition
in2-irst in3-irst in4-irst	Integer	See in1-irst definition
in2-ntyp in3-ntyp in4-ntyp	Text	See in1-ntyp definition

11.Configuration SMS

Configuration SMS can be sent by administrators to configure the users, the rights on the gate-control.

Configuration SMS are also used to set the gate-control parameters (tuning the features).

The configuration SMS is a message composed of comma separated values as follow:

```
instruction,param1,param2
```

with:

- **instruction** : max 6 chars
- **param1** : value of first parameter (max 20 chars)

- param2 : value of second parameter (max 30 chars)

11.1.Save changes, Reboot

Configuration changes must be explicitly saved with this command. Otherwise, the gate-control will use the last saved configuration at next startup.

```
Save
```

Sometime, the new parameter should be used as soon as possible.

For this, the `save` command takes `reboot` as second parameter to restart the gate-control with a soft reboot.

```
Save, reboot
```

11.2.Add user

Users with right ADD_USER (like the master) can register new user on the gate-control.

The following add +32496223320 to the users list.

```
Uadd,+32496223320
```

11.3.Delete user

Users with right ADD_USER (like the master) can delete user or admin. The master is the only user that cannot be deleted from the gate-control.

The following remove +32496223320 from the users or admins list.

```
Udel,+32496223320
```

11.4.List user

List the users on the Gate-Control. Only users having ADD_USER right (like the master) can list down the users.

```
Ulist
```

The gate-control will send one or more SMS grouping the admins & users by 5 entry.

It will starts with admins first then continue with the users. Each entry being detailed with its rights short codes.

```
Admins:  
+32477661188 : AU I1 I2 I3 I4 O1 O2 C1 C2  
Users:  
+32496998822 : C1 C2
```

Note: one of the listed admins is also the master user.

11.5.Right inspection

The command `Rview` return the rights of a given user / admin.

```
Rview,+32496223320
```

The result displays a list of right short code. The following response shows the user right for CAN_OUT1 .

```
C1
```

The following results shows the shortcodes for the master account.

```
AU I1 I2 I3 I4 O1 O2 C1 C2
```

Notice : as only the admins can send configuration message, only the admins can query the Rview .

11.6.Add right to user

The command `Radd` add one or several rights (shortcode space separated) to a given user / admin.

- Master account can update admin account (and user account).
- Admin account can update user account.
- The right ADD_USER can only be given by someone already having it.

A “Denied!” response can indicates insufficient permission to perform the operation.

The following add the notification for Input 2 to the user +32496223320.

```
Radd,+32496223320,I2
```

The following example add the input 3 & 4 as well as the Output 2 notification to the user +32496223320.

```
Radd,+32496223320,I3 I4 O2
```

11.7.Delete right from user

The command `Rdel` works the same as `Radd` (add right) except it delete a right for admin and users.

11.8.List parameters

The gate-control can be tuned by adjusting parameters. The command `Plist` list down the parameter and their value grouped by 5 items.

The command `Plist` could also get a string as first parameter to filter the parameter code (case-sensitive).

The following example list all the parameters

```
Plist
```

which results in the following SMS messages:

```
out1-sec = 3
in2-label = IN2 activated!
out2-mode = P
out2-cmd = OUT2
out1-mode = P
```

```
in3-label = IN3 activated!
out2-sec = 3
in4-label = IN4 activated!
out1-cmd = OUT1
out2-label = OUT2 activated
```

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```
poweron-label = Starting  
out1-label = OUT1 activated  
in1-label = IN1 activated!
```

The following example only list the entries related to « out1 »

```
Plist,out1
```

This time it will result in the following messages:

```
out1-sec = 3  
out1-mode = P  
out1-cmd = OUT1  
in1-label = IN1 activated!
```

11.9. Set parameter

A parameter can be adjusted with the PSet command. That command require two additional values: the parameter name (case-sensitive) and the value. See the parameter table for more information.

The following example change the message notifying users having the O1 right activated. It is the message they will receive when the Output 1 is activated.

```
Pset,out1-label,Door open!
```

The following command switch the Output 2 from Pulse mode to Toggle mode.

```
Pset,out2-mode,T
```

12.Ressources

4G-Base-Station kit

<https://shop.mchobby.be/fr/nouveaute/2888-4g-base-station-4g-controled-board-with-relays-and-optocoupled-input-micropython-ready-3232100028883.html>

Code Repository

<https://github.com/mchobby/micropython-4G-BASE-STATION>