

ANR029

CALYPSO REMOTE GPIO FEATURE

VERSION 1.1

JULY 19, 2023

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

Revision history

Manual version	Notes	Date
1.0	<ul style="list-style-type: none">Initial version	January 2022
1.1	<ul style="list-style-type: none">Updated Important notes, meta data and document style	July 2023

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1 Introduction

The Calypso WLAN module developed by Würth Elektronik eiSos is intended to be used as a radio sub-system in order to provide WLAN (IEEE 802.11) communication capabilities to systems. The UART acts as the primary interface between the module and a host micro-controller. The module can be fully configured and controlled using a set of AT-commands sent as messages via UART. Once configured, the module independently manages WLAN connectivity allowing the host controller to utilize its resources for its application tasks.

From firmware version 2.0.0 onwards, the Calypso supports the so-called "Remote GPIO" feature, which allows the configuration and control of up to 4 module GPIOs via Wi-Fi, without any intervention of a host controller. This application note gives a short overview of the new feature.

The following pins of Calypso can be configured and controlled remotely:

ID	Pad	Name	Chipset pin	Supported pin functions
0	8	<i>REMOTE_0</i>	GPIO12	Input, output
1	19	<i>REMOTE_1</i>	GPIO5	Input, output
2	24	<i>REMOTE_2</i>	GPIO10	Input, output, PWM
3	25	<i>REMOTE_3</i>	GPIO11	Input, output, PWM

Table 1: Supported pins

2 Functional description

Using the "Remote GPIO" feature of the Calypso, it is possible to set each of the supported GPIOs to output HIGH or LOW, as well as to read the externally applied logic level (i.e HIGH or LOW), in case it has been configured as input pin before. Two of the four pins can act as a PWM instead of the digital input or digital output function.

Furthermore, there is the option to store the GPIO configuration in flash memory (non-volatile), so that it is retained after a device restart. Otherwise the configuration is volatile.

The remote GPIOs can be controlled either using AT commands sent to the radio module via UART or using web API requests.

2.1 Configuration and control using AT commands

There are two AT commands to control the remote GPIOs, `At+gpioSet` and `AT+gpioGet`.

2.1.1 AT+gpioSet

The command `AT+gpioSet` is used to configure the GPIO:

Request	Response
AT+gpioSet=[id],[save],[type],[value1],[value2]	OK or error
Arguments: See Table 3	

Table 2: AT+gpioSet

Arguments	value
id	ID of the GPIO (see Table 1)
save	false - Apply only during runtime (volatile), true - Apply and save as default (non-volatile)
type	see Table 4
value1	depends on type value, see Table 4
value2	depends on type value, see Table 4

Table 3: AT+gpioSet arguments

type	value1	value2
unused	-	-
input	nopull pulldown pullup	-
output	low, high	-
pwm	PWM period (1-200) [ms]	PWM ratio (0-100) [%]

Table 4: AT+gpioSet GPIO type and valueX arguments



The flash memory used to store these settings has a limited count of write cycles. Try to avoid periodic saving to flash as each time one write cycle is used. Saving in non-volatile memory happens when using AT+gpioSet with the "save" parameter's value set to true.

Example:

Set pin *REMOTE_0* to output high, *REMOTE_1* to input pulldown and *REMOTE_2* to PWM with 100 ms interval and 75 % ratio. Furthermore, save the settings in flash.

```
AT+gpioSet=0,true,output,high,
OK
AT+gpioSet=1,true,input,pulldown,
OK
AT+gpioSet=2,true,pwm,100,75
OK
```

Code 1: Example AT+gpioSet part 1

Then toggle the pin *REMOTE_0* two times without saving it in flash.

```
AT+gpioSet=0,false,output,low,
OK
AT+gpioSet=0,false,output,high,
OK
```

Code 2: Example AT+gpioSet part 2

2.1.2 AT+gpioGet

The command AT+gpioGet is used to read the current configuration and value of the GPIO:

Request	Response
AT+gpioGet=[id],[default]	+gpioget:[id],[type],[value1],[value2] OK or error
Arguments:	
id: ID of the GPIO (see Table 1)	id: ID of the GPIO
default: true = default setting, false = current value	type, value1, value2: see Table 4

Table 5: AT+gpioGet

Example:

Read the current configuration stored in flash:

```
AT+gpioGet=0,true
+gpioget:0,output,high,
OK
AT+gpioGet=1,true
+gpioget:1,input,low,pulldown
OK
AT+gpioGet=2,true
+gpioget:2,pwm,100,75
OK
AT+gpioGet=3,true
+gpioget:3,unused,,
OK
```

Code 3: Example AT+gpioGet part 1

The pin *REMOTE_0* is configured as output high, *REMOTE_1* as input pulldown with low level applied, *REMOTE_2* as PWM with 100 ms interval and 75 % ratio, and *REMOTE_3* as unused pin.

Then externally apply a high signal to pin *REMOTE_1* and read its value again:

```
AT+gpioGet=1,false
+gpioget:1,input,high,pulldown
OK
```

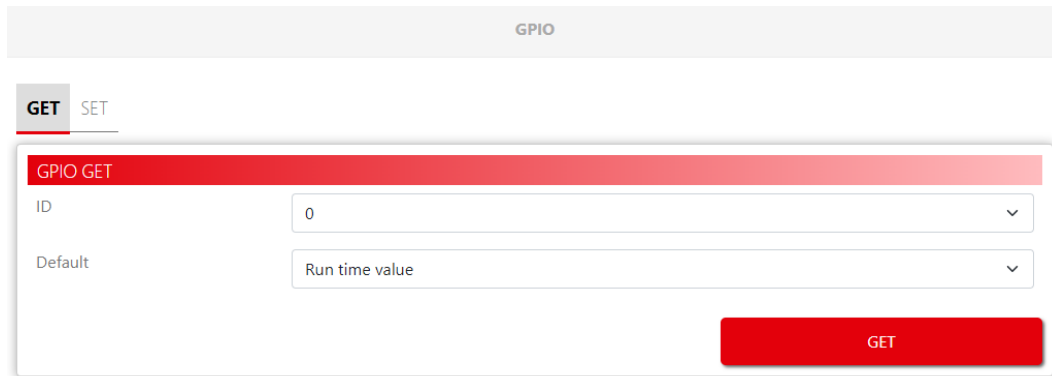
Code 4: Example AT+gpioGet part 2

2.2 Configuration and control via web interface

The on-board web server on the Calypso provides web pages that allow configuration and control of the remote GPIOs. The on-board remote GPIO configuration page can be reached from any device through a web browser.

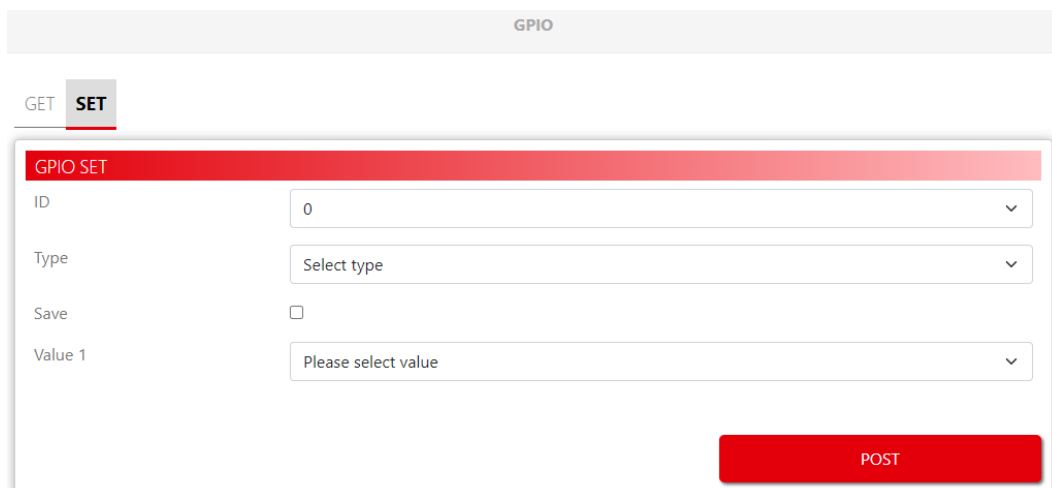
- In AP mode (provisioning): The device that accesses the website must be connected to the Calypso AP and needs to open "calypso.net/gpio.html".
- In station or P2P mode: The device that accesses the website must be in the same network as the Calypso and needs to open "[module ip]/gpio.html".
For example <http://192.168.1.101/gpio.html> in case the module's IP is 192.168.1.101

This page contains the "GET" and the "SET" tabs.



The screenshot shows the "GPIO" section with two tabs: "GET" (selected) and "SET". The "GPIO GET" form contains a red header bar, an "ID" dropdown menu set to "0", a "Default" dropdown menu set to "Run time value", and a red "GET" button at the bottom right.

Figure 1: GPIO GET tab

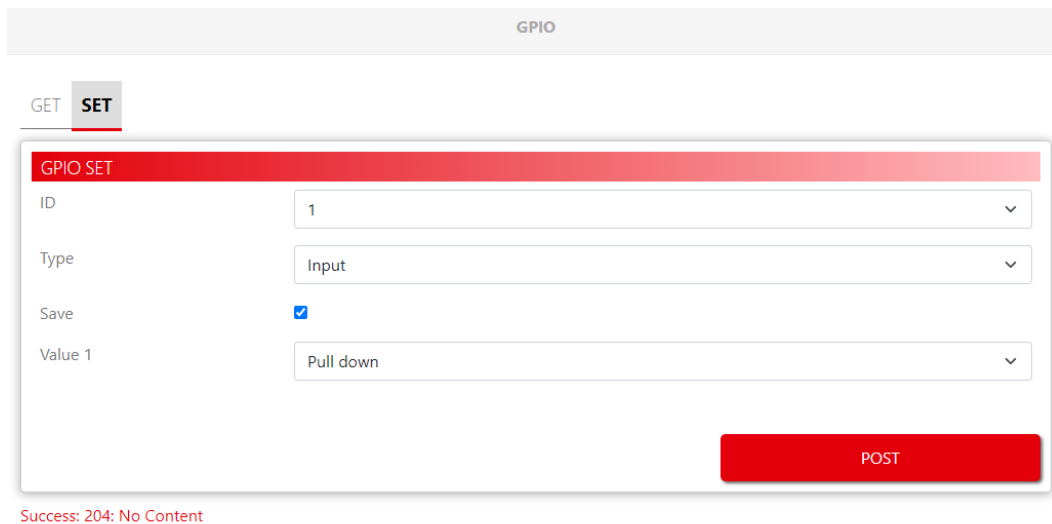


The screenshot shows the "GPIO" section with two tabs: "GET" and "SET" (selected). The "GPIO SET" form contains a red header bar, an "ID" dropdown menu set to "0", a "Type" dropdown menu set to "Select type", a "Save" checkbox, and a "Value 1" dropdown menu set to "Please select value". A red "POST" button is located at the bottom right.

Figure 2: GPIO SET tab

2.2.1 GPIO Set

In order to set a remote GPIO, in the "SET" tab, select the ID, type and the value from the dropdown menu. Check the "Save" check box to save the configuration in the flash. Finally, click on the "POST" button to send the configuration to the module. On success, the module returns code 204.



The screenshot shows the 'GPIO SET' interface. At the top, there is a 'GPIO' header. Below it, there are two tabs: 'GET' and 'SET', with 'SET' being the active tab. The main form area has a red header 'GPIO SET'. It contains four fields: 'ID' with a dropdown menu showing '1', 'Type' with a dropdown menu showing 'Input', 'Save' with a checked checkbox, and 'Value 1' with a dropdown menu showing 'Pull down'. A red 'POST' button is located at the bottom right. Below the form, a red message states 'Success: 204: No Content'.

Figure 3: GPIO SET

2.2.2 GPIO Get

In order to read a remote GPIO, in the "GET" tab, select the ID and runtime/default value from the dropdown menu. Finally, click on the "GET" button to get the configuration from the module. On success, the module returns a JSON string with the current/default state of the remote GPIO.



The screenshot shows the 'GPIO GET' interface. At the top, there is a 'GPIO' header. Below it, there are two tabs: 'GET' and 'SET', with 'GET' being the active tab. The main form area has a red header 'GPIO GET'. It contains two fields: 'ID' with a dropdown menu showing '1' and 'Default' with a dropdown menu showing 'Default value'. A red 'GET' button is located at the bottom right. Below the form, a red message displays a JSON string: '{"id": 1, "type": "input", "input config": "pulldown", "input value": "low"}'.

Figure 4: GPIO GET



The remote GPIOs on the Calypso can be accessed in all application modes except FOTA mode.



This webpage uses RESTful APIs in order to perform GET and POST requests on remote GPIO resources on the Calypso. A detailed description of these API calls can be found in chapter "The HTTP server interface" of the Calypso user manual [1]

3 References

- [1] Würth Elektronik. Calypso user manual. <https://www.we-online.de/katalog/de/manual/2610011025000>.

4 Important notes

The Application Note and its containing information ("Information") is based on Würth Elektronik eiSos GmbH & Co. KG and its subsidiaries and affiliates ("WE eiSos") knowledge and experience of typical requirements concerning these areas. It serves as general guidance and shall not be construed as a commitment for the suitability for customer applications by WE eiSos. While WE eiSos has used reasonable efforts to ensure the accuracy of the Information, WE eiSos does not guarantee that the Information is error-free, nor makes any other representation, warranty or guarantee that the Information is completely accurate or up-to-date. The Information is subject to change without notice. To the extent permitted by law, the Information shall not be reproduced or copied without WE eiSos' prior written permission. In any case, the Information, in full or in parts, may not be altered, falsified or distorted nor be used for any unauthorized purpose.

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