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| Contrôle d’un panneau solaire avec ModBus  Julien Chevalley et Nils Ritler  Systèmes d’Information - MicroControleur  S3fb  Sion, le 14.03.2023  V1.0 |



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# Introduction

The objective of this laboratory is to drive the load on a small solar panel in order to achieve the MPP (Maximum Power Point) of this solar panel. The solar panel is connected to a PIC18. This system allows the PIC to measure the current and voltage delivered by the solar panel as well as driving the load using PWM on the solar panel. This system which represent the server needs then to be driven by a client using the modbus protocol communication via UART. This project is separated in two parts :

1. Measure, display and save in registers of the solar panel parameters (Current, Voltage and PWM values)
2. Communication with the client using modbus protocol

The control and search of the MPPT is done by the client (PC connected by USB to the microcontroller). The PWM value is then feed back to the microcontroller in order to reach the MPP. The program used on the client was provided by the school.

# Description and Documentation of The Code

## Measure of Voltage, Current and setup of the PWM on the PIC

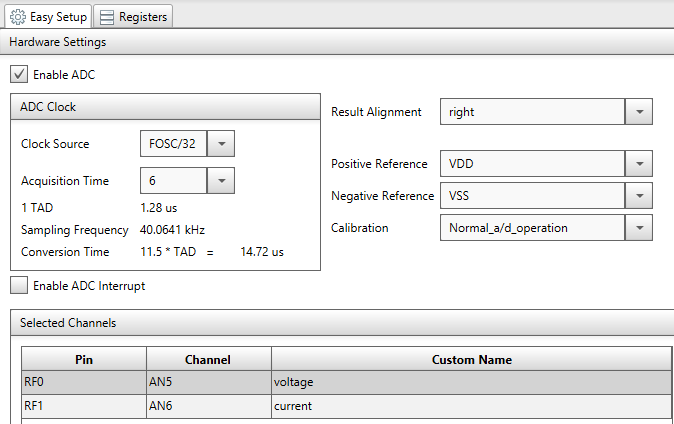
In order to perform the measures we have been given a Solar Panel with an integrated analog measurement circuit. In order to interpret the output voltage from the OpAmps we must use the Analog-to-Digital converter oft he PIC. Indeed, the OpAmps can output a voltage between 3.3V and 0V that represent the physical value to be measured.

Une image contenant diagramme, schématique

Description générée automatiquement

*Figure 1 - Analog measurement circuit of the Solar Panel*

The ADC was configured using the MCC module of MPLAB. You can see in figure 2 below how the ADC was configured. We made an additionnal change by naming channel AN6 and AN5 as current and voltage for ease-of-use later on in the code.



*Figure 2 - Setup of the Analog-To-Digittal Converter*

In order to get a coherent value, we needed to do a sampling of the measurement using the equation below :

Where n represent the sampling rate defined as AVERAGE\_SAMPLES in the measure.c file. In this case, we then take the average of 32 measures as our value. This step is encapsulated in the measure\_adc() function.

We then need to converted the 10bit sampled value in an integer that we can later on display on an LCD Screen and/or transmit via modbus.

1. Voltage

The output of the voltage opAmp which is feed into the ADC of the PIC (Pin RF0) and sampled .

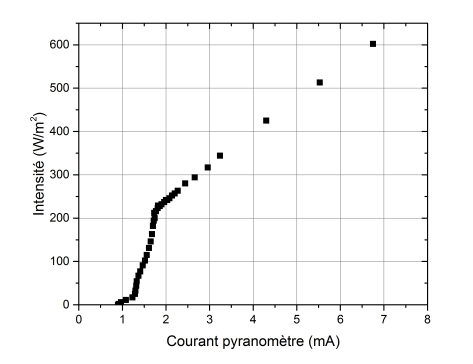
1. Current

## Setup of ModBus server and communication via RS232

# Description of problems / difficulties and corresponding solutions

## Schéma

## Mesures des Caractéristiques et Graphiques des Résultats



*Figure 3 - Courbe d'Intensité lumineuse du Pyranomètre en fonction du courant mesuré à ses bornes*

|  |  |  |  |
| --- | --- | --- | --- |
| **Caractéristiques** | **Module Polycristallin** | **Module HIT : WO6959\_7** | **Module Amorphe** |
| **Uoc [V]** | **19.40** | **0.65** | **25.13** |
| **Isc [mA]** | **54** | **1508** | **16** |
| **P\_MPP [W]** | **0.81** | **0.71** | **0.26** |
| U\_MPP [V] | 15.35 | 0.523 | 19.4 |
| I\_MPP [mA] | 53 | 1353 | 13 |
| **FF [%]** | **77%** | **72%** | **65%** |
| Surface Active A\_eff [mm2] | 20592 | 23575 | 87025 |
| Intensité mesurée [W/m2] | 307.31 | 283.22 | 290.93 |
| **η [%]** | **12.7%** | **10.6%** | **1.0%** |

*Tableau 3 - Caractéristique de chaque panneau photovoltaïque*

# Conclusion

# Annexe

# Signatures



Julien Chevalley Nils Ritler

Une image contenant texte

Description générée automatiquement

Sion, le 14 avril 2023