CWIS Ground Software User Reference Manual

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Contents

Chapter 1

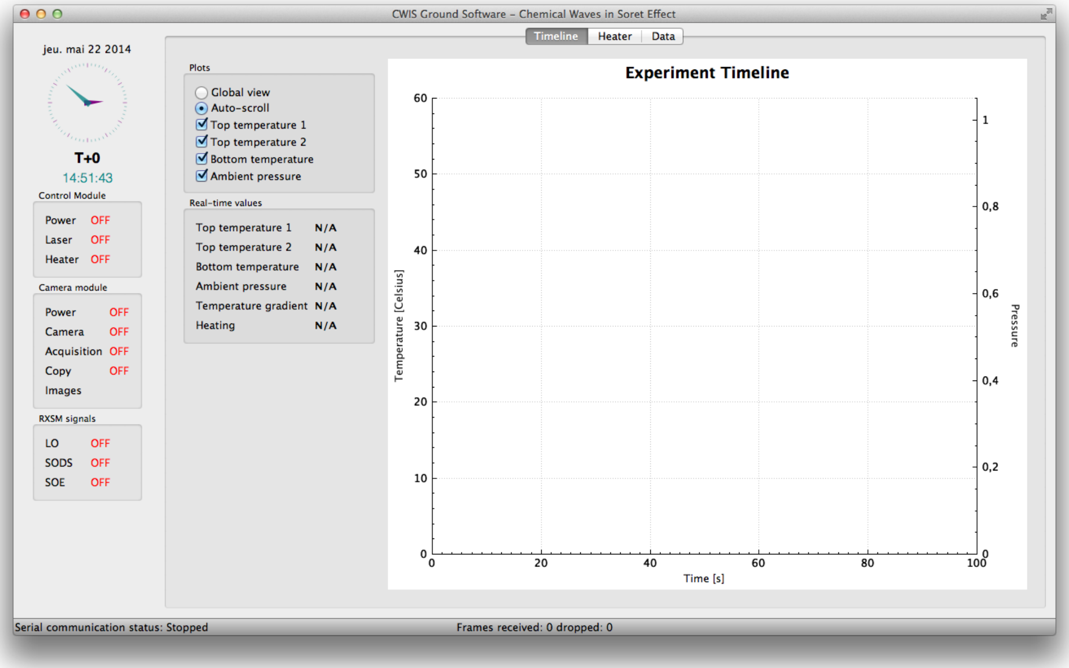
Introduction

This document describes the user interface to communicate with the CWIS Rexus/Bexus experiment. It is divided in two parts. The first describes the *ground software*, the GUI (Graphical User Interface) used to visualize data and interact with the experiment. The second describes the low level serial interface.

Chapter 2

Ground Software

2.1 Description



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T+0

14:51:43

Control Module

Power	OFF
Laser	OFF
Heater	OFF

Camera module

Power	OFF
Camera	OFF
Acquisition	OFF
Copy	OFF
Images	

RXSM signals

LO	OFF
SODS	OFF
SOE	OFF

Plots

○ Global view
● Auto-scroll
☑ Top temperature 1
☑ Top temperature 2
☑ Bottom temperature
☑ Ambient pressure

Real-time values

Top temperature 1	N/A
Top temperature 2	N/A
Bottom temperature	N/A
Ambient pressure	N/A
Temperature gradient	N/A
Heating	N/A

Serial communication status: Stopped

Frames received: 0 dropped: 0

Figure 2.1: Main interface of the ground software

The ground software is a graphical application developed in C++ using the Qt framework. It provides a complete interface to analyze the data received from the experiment through downlink communication. Furthermore, it is possible to control certain features of the experiment through this interface by sending uplink commands.

The ground software interface is divided in three tabs with a common side panel. The next sections describe those in details.

2.1.1 Side panel

The side panel on the left (see figure 2.1 displays the current status of the experiment. It is divided in 3 boxes: *control module*, *camera module* and *RXSM signals*.

The *control module* box displays the status of the microcontroller board controlling the experiment.

- The **Power** signal is switched on as soon as the module is ready.
- The **Laser** signal indicates that the laser is on.
- The **Heater** signal indicates that the heater PI control loop (and not necessarily the heater itself) is operating.

2.1.2 Timeline tab

The timeline tab (see figure 2.1) allows the user to visualize the data acquired in real-time. The main graph displays the values of the three temperature sensors and the pressure probe in real-time. By default, this graph auto-scrolls as to display the last 100 seconds of data acquired. You can change this behaviour by selecting *Global view* in the left upper corner to display all acquired data. By clicking on one of the plots, a tooltip displays the value and time of each data point.

The *real-time values* box on the left displays the values for the temperature, the pressure and the heating in real-time.

2.1.3 Heater tab

The heater tab allows the user to interact with the experiment by using the uplink channel.

2.1.4 Data tab

The data tab displays each data frame in its textual form.

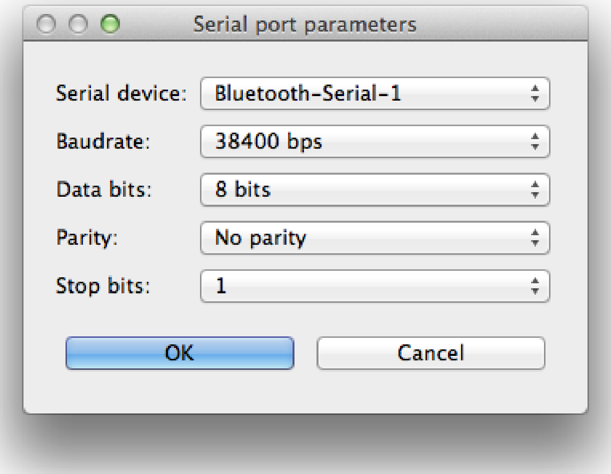
2.2 Using the ground software

2.2.1 Setting up the serial communication

Before receiving data from the experiment, it is necessary to set up the serial port connection. This is done using the *Serial port parameters* dialog accessible from the **Serial/Configuration** menu (figure 2.2.1.

After configuring it, you can start the serial communication using the **Serial/Start** action. Note that the dialog pops up automatically if you try to start an unconfigured connection.

Please note that the serial USB adapter must be connected to the computer before starting the ground software application.



Serial device: Bluetooth-Serial-1

Baudrate: 38400 bps

Data bits: 8 bits

Parity: No parity

Stop bits: 1

Figure 2.2: Serial port parameters dialog

2.2.2 Saving the data

The data can be saved in two formats. The standard saving method, using the **File/Save** menu, saves the data in a formatted file for easy parsing. The second method saves the raw data from the serial frames (see **??**), thus saving all information received from the module.

2.2.3 Basic uplink commands

The *heater tab* provides basic uplink commands to send various signals to the module. The user can:

- Send the RXSM signals (LO, SODS, SOE);
- Set the duty cycle of the heater control;
- Switch the laser on/off.

2.2.4 Automatic heater control

A more advanced use of the uplink channel is the automatic heater control. The ground software integrates a simulator of the PI control loop. It can be set to control the heater on the experiment by clicking the *Remote control* checkbox. The user can select the proportional and integral gains and the temperature setpoint.

Chapter 3

Serial interface

3.1 Downlink

The control module sends a 24-byte wide data frame every 100 milliseconds. This frame is described in figure 3.1.

0	8	16	24	32	40	48	56 63
Synchronization		System time		System time		Temperature 1	
Temperature 2		Temperature 3		Pressure		Heating	Ctrl stat
Number of images		Framerate	Cam stat	Unused		CRC	

Figure 3.1: Serial downlink frame

- **Synchronization**: Synchronization string, set to "UU". This is used to maintain synchronization between the control module and the reader application.
- **System time**: System time of the control module, in milliseconds.
- **Temperature**: Value read from the temperature sensors, from 0 to 1023.
- **Pressure**: Value read from the pressure probe, from 0 to 1023.
- **Heating**: Value of the PWM register, from 0 (0%) to 255 (100%).
- **Ctrl stat**: Status of the control module.
- **Number of images**: Number of images acquired by the camera during the experiment.
- **Framerate**: Framerate of the camera.
- **Cam stat**: Status of the camera module.
- **CRC**: Cyclic Redundancy Check value.

All values are stored in little endian (from the LSB to the MSB) except for the **Number of images** field.

0	1	2	3	4	5	6	7
Unused	SOE	SODS	LO	Heater	Unused	Laser	Power

Figure 3.2: Control module status fields

3.1.1 Control module status

Figure 3.1.1 describes the control module status bitfield. The fields are self-explanatory.

3.1.2 Camera module status

0	1	2	3	4	5	6	7
Unused				Copy	Capture	Camera	Power

Figure 3.3: Camera module status fields

Figure 3.1.2 describes the camera module status bitfield.

- The **Power** bit indicates that the module has booted.
- The **Camera** bit is set once the camera is ready for acquisition. The experiment cannot start before this bit is set.
- The **Capture** bit indicates that the camera acquisition is ongoing.
- The **Copy** bit is set while images are copied from RAM to persistent storage.

3.2 Uplink

All uplink frames are 4-byte wide, as shown in figure

0	8	16	24	31
Command	Options			

Figure 3.4: Serial uplink frame

A lot of values are possible for those parameters; for a complete description look in the code of the ground software.