RPW Calibration Software User Manual Template

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SOLAR ORBITER

RPW

ROC

RPW Operation Centre

Calbut : LFR Calibration Software User Manual

RPW-MEB-LFR-SUM-00254

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CLASSIFICATION   **PUBLIC** ☒   **RESTRICTED** ☐

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Change Record

Issue	Rev.	Date	Authors	Modifications
1	1	15/03/2017	R.Piberne B.Katra	First issue
1	2	26/09/2017	R.Piberne B.Katra	Updates according to changes made in LFR calbut

Acronym List

Acronym	Definition
RCS	RPW Calibration Software
ROC	RPW Operation Centre
RPW	Radio and Plasma Waves instrument
SUM	Software User Manual
LFR	Low Frequency Receiver
CALBUT	CALiBration software UniT
RPW	Radio and Plasma Wave analyzer
BP1	Basic Parameters set 1
BP2	Basic Parameters set 2
CWF	Continuous Waveform
SWF	Snapshot Waveform
ASM	Average Spectral Matrix
SBM1	Selected Burst Mode 1
SBM2	Selected Burst Mode 2
SURV	Survey Mode

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1 GENERAL

1.1 Scope of the Document

This User Manual explains how to install, configure and use the LFR calbut software. It is aimed at experienced users that wish to produce L1R or L2 LFR data products.

1.2 Applicable Documents

This document responds to the requirements of the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
AD1	ROC-PRO-PIP-ICD-00037/1/0	RPW Calibration Software Interface Control Document	M.Duarte, X.Bonnin	16/11/2016
AD2	ROC-PRO-DAT-NTT-00006-LES/1/0	RPW Data Products	X.Bonnin	23/12/2016
AD3	ROC-PRO-SFT-SUM-00043-LES/1/0	RPW Calibration Software User Manual Template	X.Bonnin	20/01/2017
AD4	ROC-GEN-SYS-NTT-00019-LES/2/0	ROC_Engineering_Guidelines	X.Bonnin	30/05/2017
AD5	ROC-PRO-PIP-ICD-00037-LES/1/1	RPW_Calibration_Software_ICD	M. Duarte	19/03/2017

Table 1: List of applicable documents

1.3 Reference Documents

This document is based on the documents listed in the following table:

Mark	Reference/Iss/Rev	Title of the document	Authors	Date
RD1				
RD2				
RD3				
RD4				
RD5				

Table 2: List of reference documents

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2 CONVENTIONS

LFR calbut executable will be written as follow: **$lfr-calbut.py**
Functions and options will use this convention: --input_1

3 DESCRIPTION OF THE SOFTWARE

3.1 Purpose of the software

The RPW LFR CALiBration software UniT (LFR-Calbut) was developed in order to produce RPW LFR calibrated science data. It has been built as a sub part of the ROC production pipeline.

3.2 Operations environment

Calbut is a sub-part of the RPW data production pipeline which runs at LESIA. See 3 and 4 of AD4 and 4.1 and 4.2 of AD5.

3.3 Software design overview

As recommended in 4.2.1 of AD4, the Calbut directory provides:

- A **/config** directory that stores calbut_EM.conf that is loaded by calbut.
- A **/doc** directory containing the calbut documentation.
- A **/data** directory which is empty for the moment.
- A **/scripts** directory that will be used to store scripts or batch files used to setup, run or manage S/W.
- The **/roc** (mandatory)
- An optional **/tools** directory that will be used to provide any useful tool to test, debug, validate and/or manage S/W.
- A **/bin** directory containing lfr-calbut.py, the calbut Python program.

Calbut's directory also contains the following so called *context files*:
- *readme.txt:* An ASCII format file providing general information about calbut
- *howto.txt:* An ASCII format file providing instructions to run calbut
- *install.txt:* An ASCII format file providing explanations on how to install calbut
- *release_notes.txt:* An ASCII format file providing history information about the calbut releases

and a descriptor file called roc_sw_descriptor.json.

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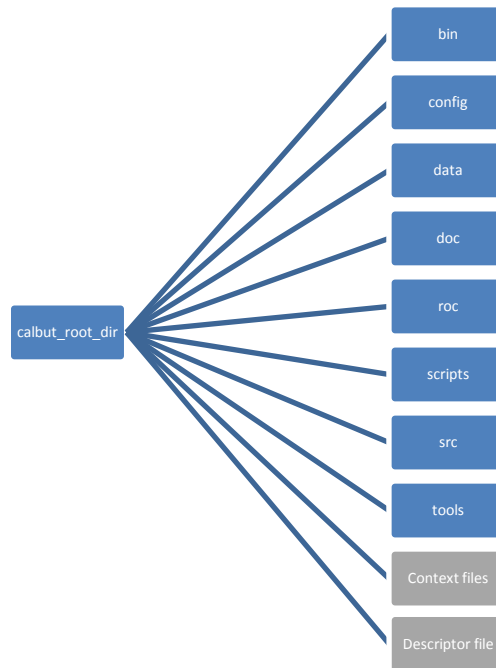
Figure 1: Calbut directory structure

3.4 External interfaces

Calbut is integrated in the ROC pipeline as a sub-part of it; refer to AD5 for detailed interfaces description.

3.5 Software operating modes

This section has been left blank intentionally.

3.6 Description of the software data

3.6.1 Software input data

Input data name	Description	Purpose	Format	Required in the following mode(s)
ROC-SGSE_L1_RPW-LFR-SBM1-BP1_V02.cdf	RPW Low Frequency Receiver Basic parameters set 1 data in SBM1 mode	Build L2 RPW Low Frequency Receiver Basic parameters set 1 data in SBM1 mode	cdf	
ROC-SGSE_L1_RPW-LFR-SBM1-BP2_V02.cdf	RPW Low Frequency Receiver Basic parameters set 2 data in SBM1 mode	Build L2 RPW Low Frequency Receiver Basic parameters set 1 data in SBM1 mode	cdf	
ROC-SGSE_L1_RPW-LFR-SBM1-CWF_V02.cdf	RPW Low Frequency Receiver Continuous Waveform data in SBM1 mode	Build L1R RPW Low Frequency Receiver Continuous Waveform data in SBM1 mode	cdf	lfr_sbm1_cwf_l1r
ROC-	RPW Low Frequency	Build L2 RPW Low	cdf	

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SGSE_L1_RPW-LFR-SBM2-BP1_V02.cdf	Receiver Basic parameters set 1 data in SBM2 mode	Frequency Receiver Basic parameters set 1 data in SBM2 mode		
ROC-SGSE_L1_RPW-LFR-SBM2-BP2_V02.cdf	RPW Low Frequency Receiver Basic parameters set 2 data in SBM2 mode	Build L2 RPW Low Frequency Receiver Basic parameters set 2 data in SBM2 mode	cdf	
ROC-SGSE_L1_RPW-LFR-SBM2-CWF_V02.cdf	RPW Low Frequency Receiver Continuous Waveform data in SBM2 mode	Build L1R RPW Low Frequency Receiver Continuous Waveform data in SBM2 mode	cdf	lfr_sbm2_cwf_l1r
ROC-SGSE_L1_RPW-LFR-SURV-ASM_V02.cdf	RPW Low Frequency Receiver Average Spectral Matrices data in survey mode	Build L2 RPW Low Frequency Receiver Average Spectral Matrices data in survey mode	cdf	
ROC-SGSE_L1_RPW-LFR-SURV-BP1_V02.cdf	RPW Low Frequency Receiver Basic parameters set 1 data in Survey mode	Build L1R RPW Low Frequency Receiver Basic parameters set 1 data in Survey mode	cdf	
ROC-SGSE_L1_RPW-LFR-SURV-BP2_V02.cdf	RPW Low Frequency Receiver Basic parameters set 2 data in Survey mode	Build L1R RPW Low Frequency Receiver Basic parameters set 2 data in Survey mode	cdf	
ROC-SGSE_L1_RPW-LFR-SURV-CWF_V02.cdf	RPW Low Frequency Receiver Continuous Waveform data in survey mode	Build L1R RPW Low Frequency Receiver Continuous Waveform data in survey mode	cdf	lfr_surv_cwf_l1r
ROC-SGSE_L1_RPW-LFR-SURV-SWF_V02.cdf	RPW Low Frequency Receiver Snapshot Waveform data in survey mode	Build L1R RPW Low Frequency Receiver Snapshot Waveform data in survey mode	cdf	lfr_surv_swf_l1r

Table 3: Calbut input data list

3.6.2 Software output data

Output data name	Description	Format	Product of the following mode(s)
ROC-SGSE_L2_RPW-LFR-SBM1-BP1_V02.cdf	RPW Low Frequency Receiver Basic parameters set 1 data in SBM1 mode	cdf	
ROC-SGSE_L2_RPW-LFR-SBM1-BP2_V02.cdf	RPW Low Frequency Receiver Basic parameters set 2 data in SBM1 mode	cdf	
ROC-SGSE_L1R_RPW-LFR-SBM1-CWF-B_V02.cdf	RPW Low Frequency Receiver Continuous Waveform magnetic data in SBM1 mode	cdf	lfr_sbm1_cwf_l1r
ROC-SGSE_L1R_RPW-LFR-SBM1-CWF-E_V02.cdf	RPW Low Frequency Receiver Continuous Waveform electric data in SBM1 mode	cdf	lfr_sbm1_cwf_l1r
ROC-SGSE_L2_RPW-LFR-SBM2-BP1_V02.cdf	RPW Low Frequency Receiver Basic parameters set 1 data in SBM2 mode	cdf	
ROC-SGSE_L2_RPW-LFR-SBM2-BP2_V02.cdf	RPW Low Frequency Receiver Basic parameters set 2 data in SBM2 mode	cdf	
ROC-SGSE_L1R_RPW-LFR-SBM2-CWF-B_V02.cdf	RPW Low Frequency Receiver Continuous Waveform magnetic data in SBM2 mode	cdf	lfr_sbm2_cwf_l1r

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| ROC-SGSE_L1R_RPW-LFR-SBM2-CWF-E_V02.cdf	RPW Low Frequency Receiver Continuous Waveform electric data in SBM2 mode	cdf	lfr_sbm2_cwf_l1r
ROC-SGSE_L2_RPW-LFR-SURV-ASM_V02.cdf	RPW Low Frequency Receiver Average Spectral Matrices data in survey mode	cdf	
ROC-SGSE_L2_RPW-LFR-SURV-BP1_V02.cdf	RPW Low Frequency Receiver Basic parameters set 1 data in Survey mode	cdf	
ROC-SGSE_L2_RPW-LFR-SURV-BP2_V02.cdf	RPW Low Frequency Receiver Basic parameters set 2 data in Survey mode	cdf	
ROC-SGSE_L1R_RPW-LFR-SURV-CWF-B_V02.cdf	RPW Low Frequency Receiver Continuous Waveform magnetic data in survey mode	cdf	lfr_surv_cwf_l1r
ROC-SGSE_L1R_RPW-LFR-SURV-CWF-E_V02.cdf	RPW Low Frequency Receiver Continuous Waveform electric data in survey mode	cdf	lfr_surv_cwf_l1r
ROC-SGSE_L1R_RPW-LFR-SURV-SWF-B_V02.cdf	RPW Low Frequency Receiver Snapshot Waveform magnetic data in survey mode	cdf	lfr_surv_swf_l1r
ROC-SGSE_L1R_RPW-LFR-SURV-SWF-E_V02.cdf	RPW Low Frequency Receiver Snapshot Waveform electric data in survey mode	cdf	lfr_surv_swf_l1r

Table 4: Calbut output data list

3.6.3 Software installation and configuration files

N/A : the installation process consists of the upload and the integration of the software into the ROC pipeline. These steps are done entirely by the ROC, as explained in 4.2.3 of AD5.

3.6.4 Software internal data files

When using the --log option followed by the path of the directory log in calbut, a log file is created (YYYY-MM-DDThh-mm:ss.log). Currently, several messages are printed into the log file but not the error message. Hereafter is an example of a log file generated for the call of the function lfr_surv_swf_l1r :

```
LOG: LFR CALBUT function:        lfr_surv_swf_l1r
LOG: Input files directory:      ../input
LOG: Output files directory:     ../output
LOG: Configuration file:
    ../../SW/LFR_CALBUT/config/calbut_EM.conf
LOG: CDF masters directory set to: /home/pi/LFR/Datapool/GSE/ROC-
SGSE/CDF/Master
LOG: Processing Calbut function: lfr_surv_swf_l1r...
LOG: L1 file found:              ../input/ROC-SGSE_L1_RPW-LFR-SURV-
SWF_bf724e0_CNE_V02.cdf
LOG: Master CDF that will be used for electric L1R:
    /home/pi/LFR/Datapool/GSE/ROC-SGSE/CDF/Master/ROC-SGSE_L1R_RPW-LFR-
SURV-SWF-E_V01.cdf
```

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```
LOG:   Master   CDF   that   will   be   used   for   magnetic   L1R:
      /home/pi/LFR/Datapool/GSE/ROC-SGSE/CDF/Master/ROC-SGSE_L1R_RPW-LFR-
SURV-SWF-B_V01.cdf

LOG: L1r files that will be produced:    ../output/ROC-SGSE_L1R_RPW-LFR-
SURV-SWF-E_bf724e0_CNE_V02.cdf

                            ../output/ROC-SGSE_L1R_RPW-LFR-SURV-SWF-
B_bf724e0_CNE_V02.cdf

LOG: Number of records:      198
```

As explained in 3.3, the folder config stores the calbut configuration files called calbut_EM.conf. This file contains the path to the masters' directory and the conversion factors for all LFR products from counts to volts.

3.6.5 Software testing data files

This section has been left blank intentionally.

4 REFERENCE MANUAL

4.1 Software configuration requirements

4.1.1 General

Calbut was developed as a sub-part of the ROC pipeline and it needs this pipeline to be fully functional; refer to 4.1 of AD5 for more details.

4.1.2 Hardware configuration requirements

This section has been left blank intentionally.

4.1.3 Software configuration requirements

Calbut was developed under a Linux platform. In order to run properly, it needs:

- Python 3.x

- The python spacepy library (https://pythonhosted.org/SpacePy)

- The CDF Software distribution (https://cdf.gsfc.nasa.gov/html/sw_and_docs.html)

4.2 Operations manual

4.2.1 Setup and initialisation

As being integrated in the ROC production pipeline, calbut does not need any setup or initialisation.

4.2.2 Getting started

A typical calbut call is:

RPW-MEB-LFR-SUM-00254-Calbut_Software_User_Manual_Iss01_Rev01.docx

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Python3 lfr-calbut.py `func1 --input_1 /path/to/input1`

`--output    /output/directory/path    --log    /path/to/log    --config /path/to/calbut_EM.conf`

Where:
- `func1` is one of the functions detailed in 4.2.8.
- `/path/to/input1` is the path to one of the input files listed in 3.6.1.
- `/output/directory/path` is the directory path of the output files.
- `/path/to/log` is the directory path of the log files.
- `/path/to/calbut_EM.conf` is the path to the configuration file.

The user could also called calbut with the `--help` option (see 4.2.7).

4.2.3 Normal operations

This section has been left blank intentionally.

4.2.4 Normal termination

Calbut is compliant with 3.3 of AD5. If the S/W ends with no error, the standard output (*stdout*) returns a list of the output files produced in the JSON format. For instance:

```
{
"output_cdf1": "output_filename1.cdf",
"output_cdf2": "output_filename2.cdf",
}
```

where `"output_cdf1"` and `"output_cdf2"` are the name of the `"outputs"` JSON objects as defined in roc_sw_descriptor.json, `"output_filename1.cdf"` and `"output_filename2.cdf"` are the name of the output files produced by the current calbut function.

4.2.5 Error conditions

Calbut is compliant with 3.4 of AD5. Any exit code other than 0 indicates that there is a problem in the process.

4.2.6 Recover runs

This section has been left blank intentionally.

4.2.7 Help method

Calbut is compliant with 3.2.4 of AD5. To obtain help, the user should call:

$lfr-calbut.py `--help`

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4.2.8 Commands and operations

Calbut is compliant with 3.2.3 of AD5. As explained in 4.2.2, a typical calbut call is:

```
$lfr-calbut.py func1 --input_1 /path/to/input1
--output    /output/directory/path    --log    /path/to/log    --config
/path/to/calbut_EM.conf
```

Where func1 corresponds to one of the following functions:

Function name	Purpose
lfr_sbm1_cwf_l1r	Produce calibrated CWF LFR data file for SBM1 at analyser level (L1r)
lfr_sbm2_cwf_l1r	Produce calibrated CWF LFR data file for SBM2 at analyser level (L1r)
lfr_surv_swf_l1r	Produce calibrated SWF LFR data file for survey mode at analyser level (L1r)
lfr_surv_cwf_l1r	Produce calibrated CWF LFR data file for survey mode at analyser level (L1r)

Table 5: Calbut functions

4.2.9 Error messages

Calbut is compliant with 3.4 of AD5. If a problem occurs, it exits with an error code written in the standard error (stderr).

4.2.10 Software testing operations

This section has been left blank intentionally.

4.2.11 Software upgrading operations

Calbut is updated according to the Proc delivery procedure. See 4.2 of AD5 for more details.

4.2.12 Software uninstalling operations

This section has been left blank intentionally.

5 TUTORIAL

5.1 Introduction

This section has been left blank intentionally.

5.2 Getting started

This section has been left blank intentionally.

5.3 Using the software on a typical task

This section has been left blank intentionally.

6 APPENDICES

6.1 Troubleshooting & know issues

7 LIST OF TBC/TBD/TBWS

TBC/TBD/TBW			
Reference/Page/Location	Description	Type	Status

8 DISTRIBUTION LIST

LISTS See Contents lists in "Baghera Web": Project's informations / Project's actors / RPW_actors.xls and tab with the name of the list or NAMES below		Tech_LESIA
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		Tech_RPW
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