Instituto Geofísico del Perú

JROMAG-103 SOFTWARE MANUAL VER 3.1

2024

SUMMARY

This document details the configuration and operation of the JROMAG-MAG103 series magnetometer acquisition software, integrated with a Raspberry Pi single-board computer (SBC) in the Control Unit.

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1. PANEL CONNECTIONS

Figure 1 shows the layout of the connectors on the rear panel:

1. USB Output- serial data output.
2. Ethernet connection (RJ45)- For network connection.
3. SBC Module-For USB memory connection (32G) and USB cable to USB OUTPUT (type USB A/B).
4. GPS antenna connector.

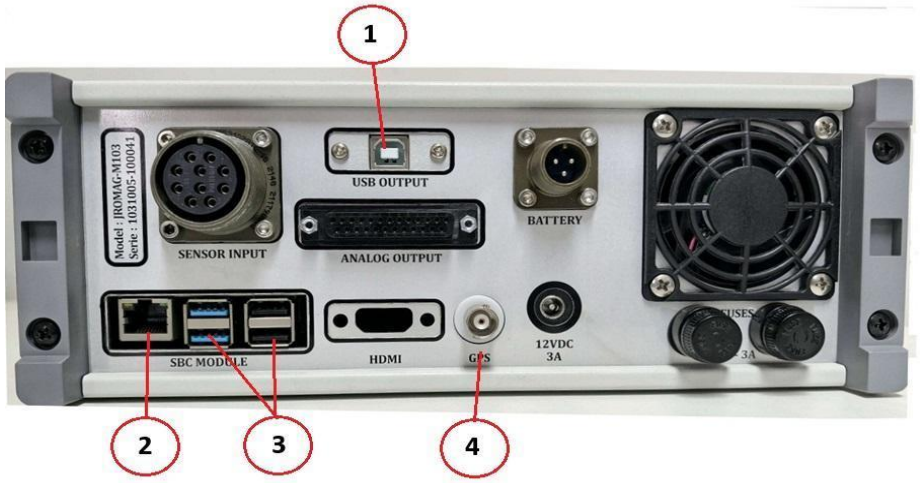

Figure 1. *Connectors distribution on rear panel.*

Setup steps:

1. Ensure the computer is off
2. Connect the USB A/B cable between the USB OUTPUT and any USB port on the SBC MODULE.
3. Insert the USB memory stick into another USB port on the SBC MODULE.
4. Connect the network cable between SBC MODULE and another device (Desktop/Laptop, router, switch, etc.).
5. Attach the GPS antenna.
6. Connect the sensor cable to SENSOR INPUT.
7. Plug in the 12V power input.
8. Turn on the equipment with the POWER switch on the front panel.

By default, the IP address of the SBC Magnetometer is ***10.10.40.XX*** included in each magnetometer sheet. To change it proceed as follows:

Alternative with SSH:

a. Configure the IP address of a device connected to the magnetometer (refer to Step 3) to 10.10.40.100 with an optional Gateway of 10.10.40.1.

b. To confirm the connection, use the ping command to 10.10.40.X. If there is no response, verify that the magnetometer is powered on, the network cable is properly connected, and that the device's network configuration is correct.

Use an SSH client, with the following connection options:

IP: 10.10.40.X
user: pi
password: 0x1y2z

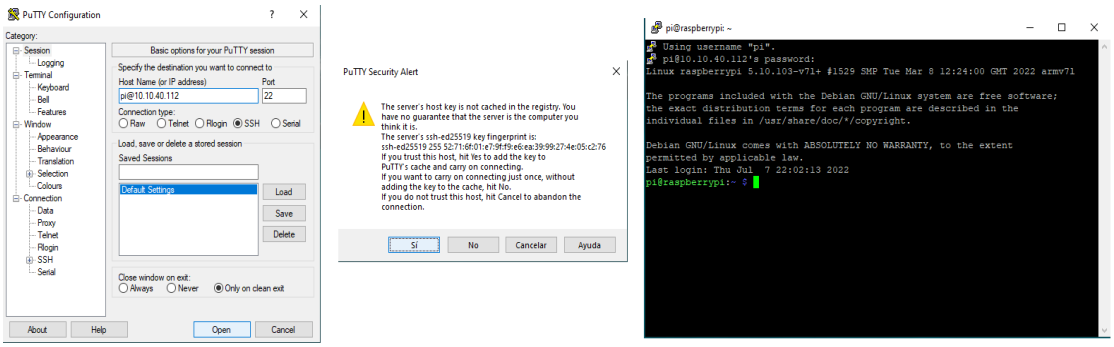

Figure 2. *Example of an SSH connection using PuTTy.exe.*

After establishing the SSH connection, update the network configuration by modifying the last three lines in the dhcpcd.conf file to match the local network settings:

For example:

```
static ip_address=192.168.0.10/24
static routers=192.168.0.1
static domain_name_servers=8.8.8.8
```

To edit the configuration file, use the command:

```
sudo nano /etc/dhcpcd.conf
```

After editing, press CTRL + X, then Y to save changes.

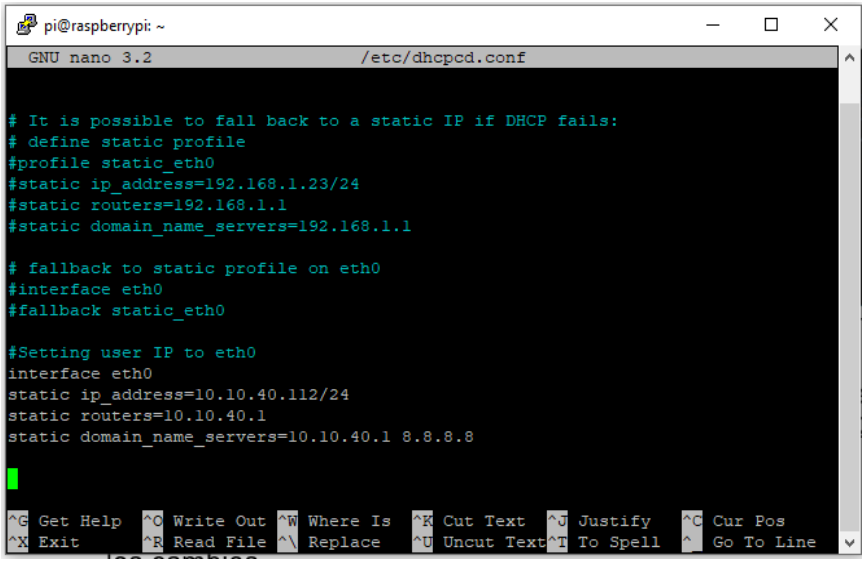

Figure 3. *IP change in magnetometer.*

Finally restart it with:

```
sudo reboot
```

Note: *If an error occurs and the dhcpcd.conf file is incorrectly edited, network access may be lost. To resolve this, remove the micro-SD card from the Raspberry Pi, connect it to a Linux computer (such as one running Ubuntu) via a microSD/USB adapter, and re-edit the file at /media/[user PC]/rootfs/etc/dhcpcd.conf.*

Alternative with VNC:

Another alternative way of remote (local) connection is by using the VNC protocol to change the IP address of the magnetometer. For this it is necessary to install the program "VNC Viewer" (free). It should continue as soon as the magnetometer 10.10.40.X responds to the ping command.

a. Run the VNC Viewer program, create a new connection with the following parameters: IP:10.10.40.X, user:pi, password:0x1y2z.

b. Once connected, we have access to the graphical interface of the magnetometer's OS. We can proceed as in any Debian distribution.

c. We open a new command console (CTRL + ALT + T) and type the command sudo nano /etc/dhcpcd.conf to make the same change as above.

Finally restart it with the command:

```
sudo reboot
```

After turning the equipment back on, verify the internet connection and remote access by Anydesk program. The password for remote connection by Anydesk is 0x1y2z3a. You can download this software in: https://anydesk.com/en/downloads/thank-you?dv=win_exe

2. SYSTEM CONFIGURATIONS

Before turning on the equipment, check the connections indicated in the CONNECTION PANEL section. Then follow the steps below:

Step 1: Turn on the magnetometer and wait for the operating system to load (5 minutes maximum). Then establish a connection by VNC (local network) or Anydesk (internet). Once the connection is established, the OS will be accessed as shown in the following figure.

Step 2: We go to the working folder where all the programs and scripts for the execution of the acquisition program are located, its location is the local folder /home/pi/MagnetProgram.

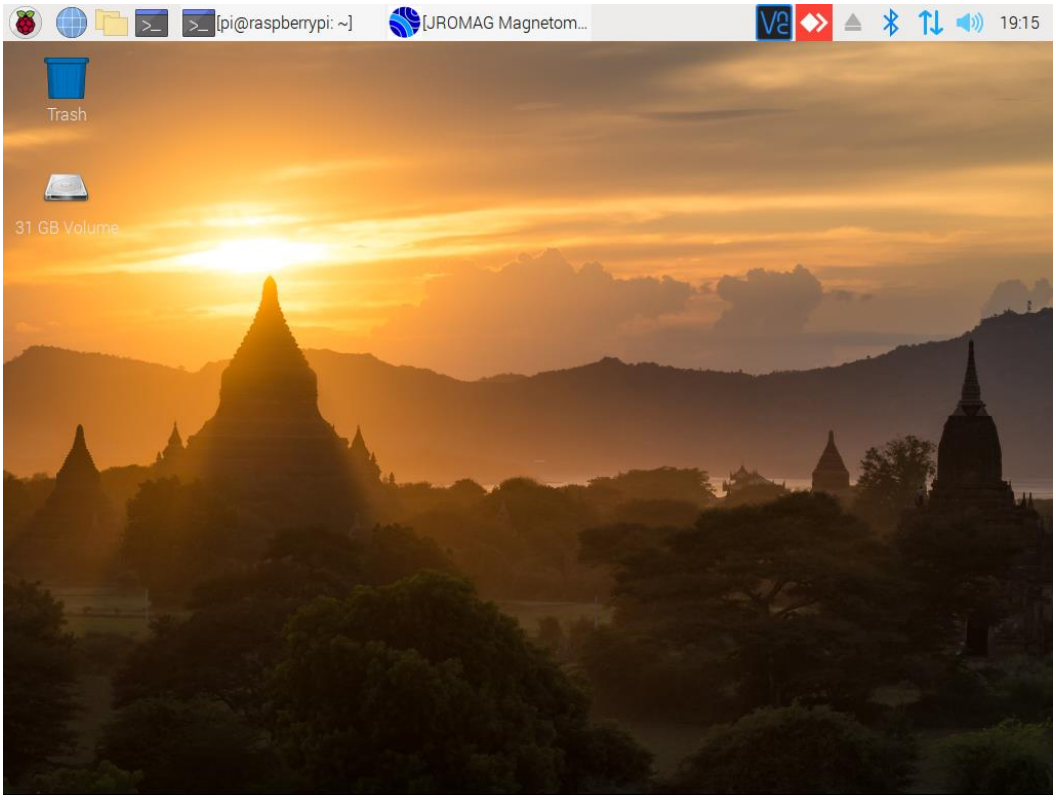

Figure 5. *OS Raspbian in Raspberry Pi.*

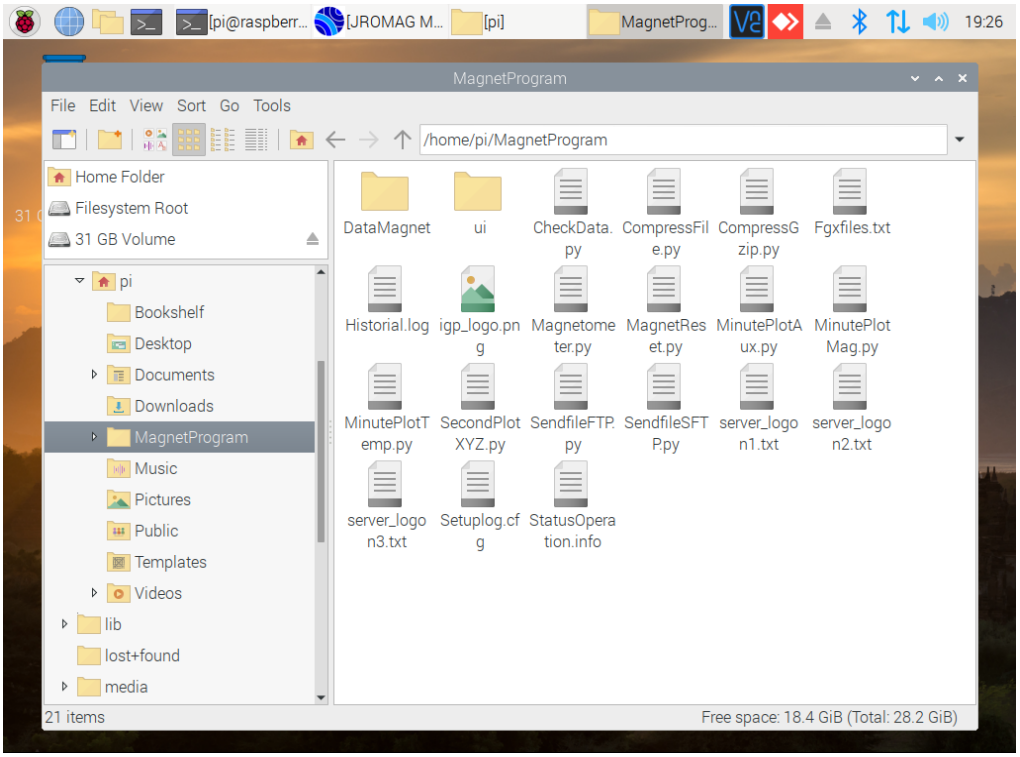

Figure 6. */home/pi/MagnetProgram Work Folder.*

The scripts for the execution of the acquisition program are developed in Python3, it is recommended not to make any type of modification in these files for proper functioning.

Step 3: For the execution of the acquisition program, the last line of the StatusOperation.info file must be edited. With this line we enable/disable the execution of the program. We will select the StatusOperation.info file to be able to view and edit its content. The first few lines of the file show the two possible options for the operation of the acquisition program: STOPPED to disable it and RECORDING to enable it.

With "Status: RECORDING" the acquisition program will run automatically every time the computer is turned on or restarted. The execution of the magnetometer data logging monitoring script will also be enabled. This script is called CheckData.py and is responsible for restarting the acquisition system when it does not find data recorded the minute before the script was executed.

The restart history is stored in the ResetLog.txt file. The monitoring frequency is set with the crontab, being set to be run every 17 minutes (*/17 * * * *).

Once we have access to the file StatusOperation.info delete the word STOPPED and type RECORDING, the last line should be as shown in the following figure 7.

Finally, we save the changes made and close the file. All of the above can be done with the "nano" command from a terminal or console.

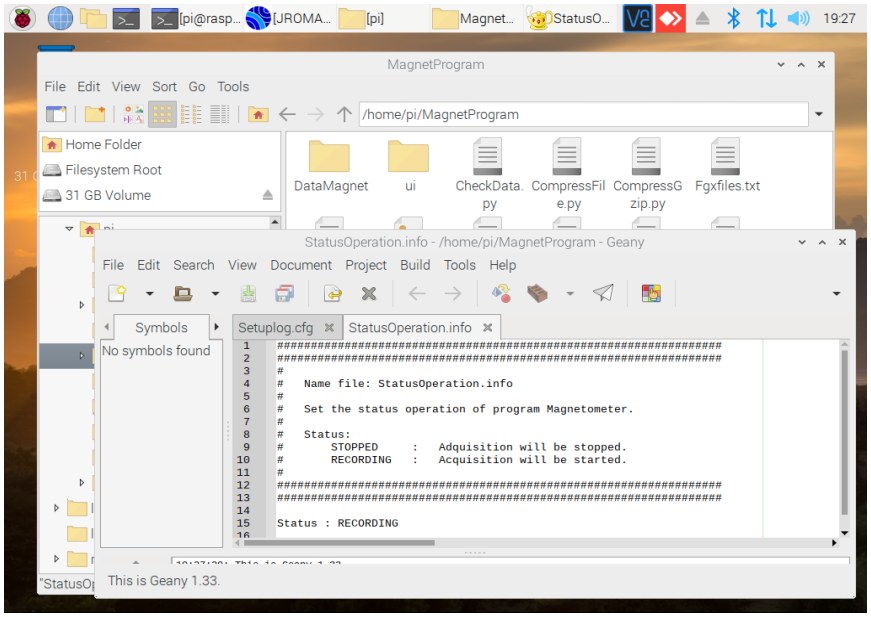

Figure 7. *File Contents StatusOperation.info.*

Once we have access to the file StatusOperation.info delete the word STOPPED and type RECORDING, the last line should be as shown in the following figure 7.

Finally, we save the changes made and close the file. All of the above can be done with the "nano" command from a terminal or console.

Step 4: In the working folder we find and open the Setuplog.cfg file to edit the lines of the following parameters: Station, IAGA code, Magnetometer, Enable GPS and USB device mount.

On each line, after the commas and between the double quotation marks, we write the content of the parameter as appropriate, for this it is indicated:

“Station	”,”Station Name”
“IAGA code	”,”Three uppercase letters to abbreviate the station”
“Magnetometer	”,”For identification of each magnetometer”
“Enables GPS	”,”Enabling/disabling the use of GPS”
“USB device mount	”,”USB Stick Partition”

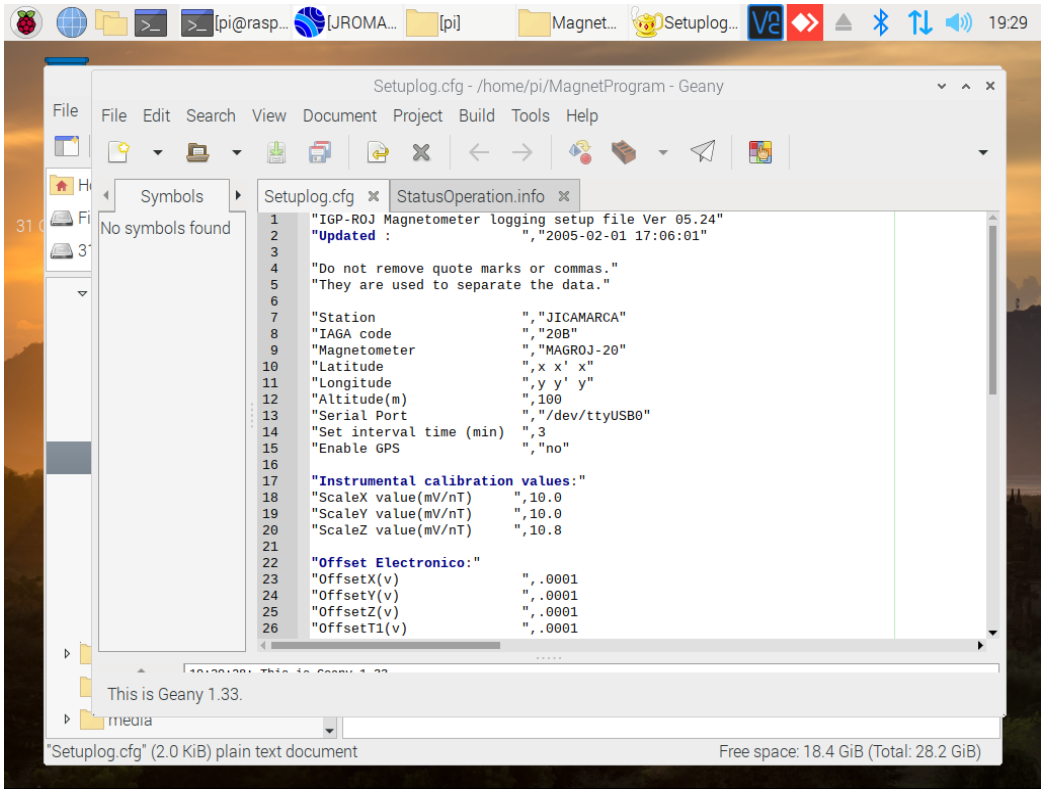

Figure 8. *Contents of the Setuplog.cfg configuration file.*

Step 5: Once all these parameters are established, we will edit the Setuplog.cfg file to proceed with the acquisition and data logging.

For this example, we have edited the content of the following parameters according to the station name, IAGA identification and magnetometer number where the instrument will operate.

“Station	”,”JICAMARCA”
“IAGA code	”,”20B”
“Magnetometer	”,”MAGROJ-20”
“Enables GPS	”,”no”
“USB device mount	”,”/dev/sda1”

For the rest of the parameters, it is recommended not edit them as it could vary the calibration of the equipment. The list of parameters and their function will then be displayed.

Parameters	Function	Editable
Station	To identify the station.	Yes
IAGA code	For generating the names of the data files.	Yes
Magnetometer	To identify the equipment.	Yes
Latitude	Latitude location.	Yes
Longitude	Longitude location	Yes
Altitude (m)	Location altitude.	Yes
Serial Port	Communication port.	No
Set interval time (min)	Time Interval for Sending Files to the Server.	Yes
Enable GPS	To enable or not to enable GPS.	Yes
ScaleX value(mV/nT)	X scale value.	Based on range selection.
ScaleY value(mV/nT)	Y scale value.	Based on range selection.
ScaleZ value(mV/nT)	Z scale value.	Based on range selection.
Offset X(v)	Voffset value of X	If necessary.
Offset Y(v)	Voffset Value of Y	If necessary
Offset Z(v)	Voffset value of Z	If necessary
Offset T1(v)	Voffset value of T1	If necessary
Offset T2(v)	Valor de Voffset de T2	If necessary
LBaseH	Baseline for H	According to: IGRF model
LBaseY	Baseline for Y	
LBaseZ	Baseline for Z	
Hmean(nT)	Mean Baseline for H	According to yearly mean.
Dmean(Grados)	Mean Baseline for D	
Zmean(nT)	Mean Baseline for Z	
cte1 pendiente	Conversion Constant.	No
cte2 intersecto	Conversion Constant	No
Temp reference(mv)	Reference temperature value (night time)	If necessary
TX factor(mv)	Correction factor for X	If necessary
TY factor(mv)	Correction factor for Y	If necessary
TZ factor(mv)	Correction factor for Z	If necessary
PathS segundos	Local seconds file path.	Yes, but not recommended.

PathM minutos	Local minute file path.	Yes, but not recommended.
PathZ zipdata	Local Zip file path.	Yes, but not recommended.
PathT tempdata	Local temporary files.	Yes, but not recommended.
Server1 path (using FTP)	Server Path 1 for envío de records.	Si
Server2 path (using FTP)	Server Path 2 for File Submission.	Yes
Server3 path (using FTP)	Server Path 3 for File Submission.	Yes
Enable SFTP send	Enabler of sending by SFTP.	Yes
Server4 path (using SFTP)	Server Path 4 for Sending Files.	Yes
USB device mount	USB memory partition	Yes

Paso 6: After you have configured the parameters correctly in the Setuplog.cfg file we save the changes and close. To run the acquisition program, use the command:

```
python3 /home/pi/MagnetProgram/Magnetometer.py
```

It will then start the acquisition with the parameters configured in Setuplog.cfg.

Figure 9 shows how the program works. Note that the USB stick icon appears on the desktop indicating that the acquisition program correctly mounted the device by saving the data there. From now on you can leave the equipment operating.

Note: If you need to make any modifications to the Setuplog.cfg file you can click on the Settings menu of the acquisition program to edit it. When the RaspberryPi is restarted, the acquisition program will automatically run without displaying the messages in the console.

The magnetometer is equipped with a server to share the contents of the data folders (Pi DataMagnet) and the user folder (Pi Magnet). The login credentials are: user:pi, password:0x1y2z.

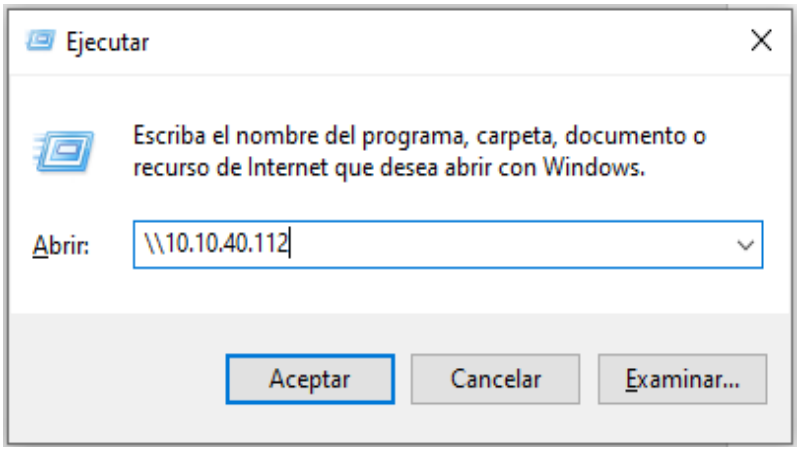

Figure 10. *Shared folder access from Windows ([WIN] + R).*

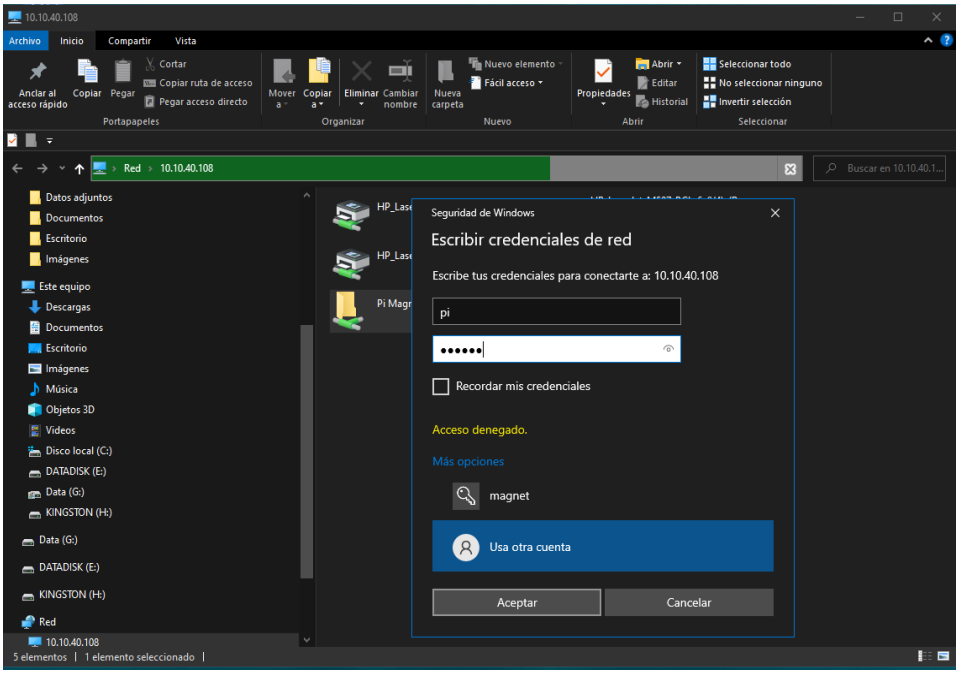

Figure 11. *Entering credentials to access shared folders.*

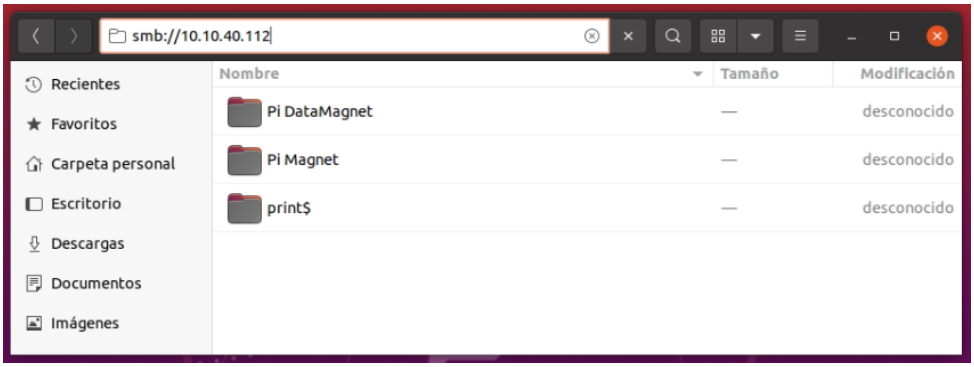

Figure 12. *Shared folder access from Ubuntu (SMB).*

3. DATA ACQUISITION PROGRAM

The purpose of the acquisition program "Magnetometer.py" developed in Python platform is to record the acquired data each second and save it to local files. The program generates six types of files:

Minute data file:

File type	Data type
*.[year]m => *.24m	Magnetic comp.: D and I in deg, H, Z, F in nT.
*.[year]v => *.24v	Data H, Y, Z, Temp. Control y Temp. Sensor in mV.
*.[year]t => *.24t	Data Temp. AUX0, AUX1, AUX2 and Logger in °C
*.min	Comp. magnetics: H, Y, Z y F in nT

Second data file:

File type	Data type
*.[year]s => *.24s	Data from all channels in mV. H, Y, Z, Temp. Control, Temp. Sensor, AUX0, AUX1, AUX2, Temp. Logger.
*.[year]r => *.24r	Data from 5 channels in mV. H, Y, Z, Temp. Control, Temp. Sensor

File names (example: October 28, 2024: 19 h):

Minute files	*.24m, *.24v, *.24t	[IAGA][day][month].24*
	*.min	[IAGA]_[year][month][day].min
Seconds files	*.24s, *.24r	[IAGA][day of year][hour].24*

According to step 5:

20b28oct.24m
20b28oct.24v
20b28oct.24t
20b_20241028.min
20b30219.24s
20b30219.24r

These files are reported to different servers by an Internet connection using the FTP/SFTP protocols. The access credentials are located in the files: server_logon1.txt, server _logon2.txt and server _logon3.txt according to the order of the paths in the Setuplog.cfg file.

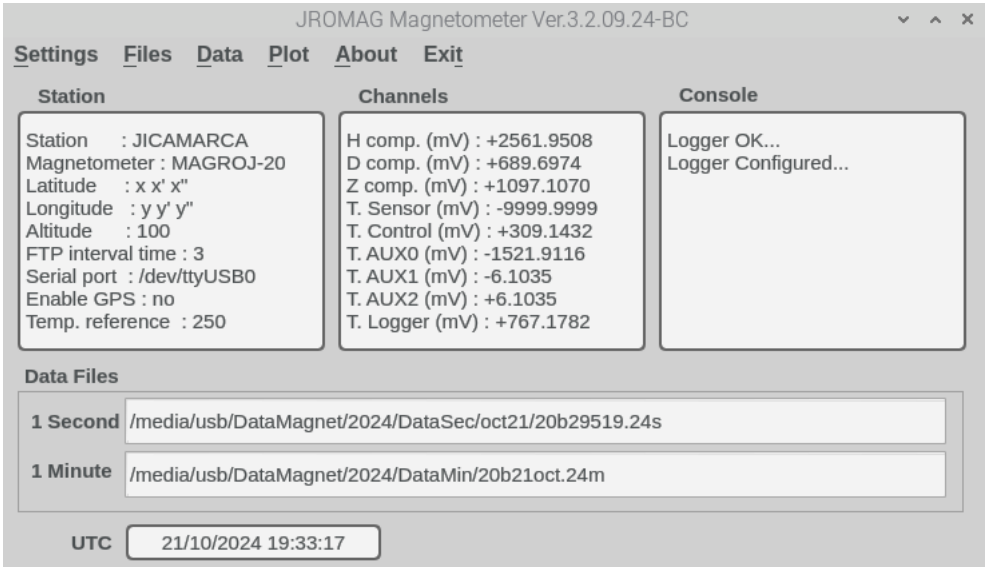

Figure 13. *Graphical interface window of the acquisition program.*

Figure 13 shows the acquisition program where data acquisition information is shown, for example we have the menus:

- Settings: To display and modify the Setuplog.cfg configuration file.
- Files: To display file names and paths on servers.
- Data: To display the minute/second data files.
- Plot: To display the magnetograms with the minute/second data that were acquired on the present day/hour until the last minute/second recorded. This chart is not updated, so it is recommended to close and reopen it. You can also select to display temperature variations.
- Exit: To close the program.
- Station window: Presents station parameters of the Setuplog.cfg file.
- Channels window: Presents the channels with the information from the digitized data. The information is displayed with voltage units and physical units. To change the units, go to the Data >> view menu >> select units.
- Console window: Presents the operational information of the acquisition program.
- Data Files window: The path and name where the second/minute data files are stored.
- UTC field: System time and date.

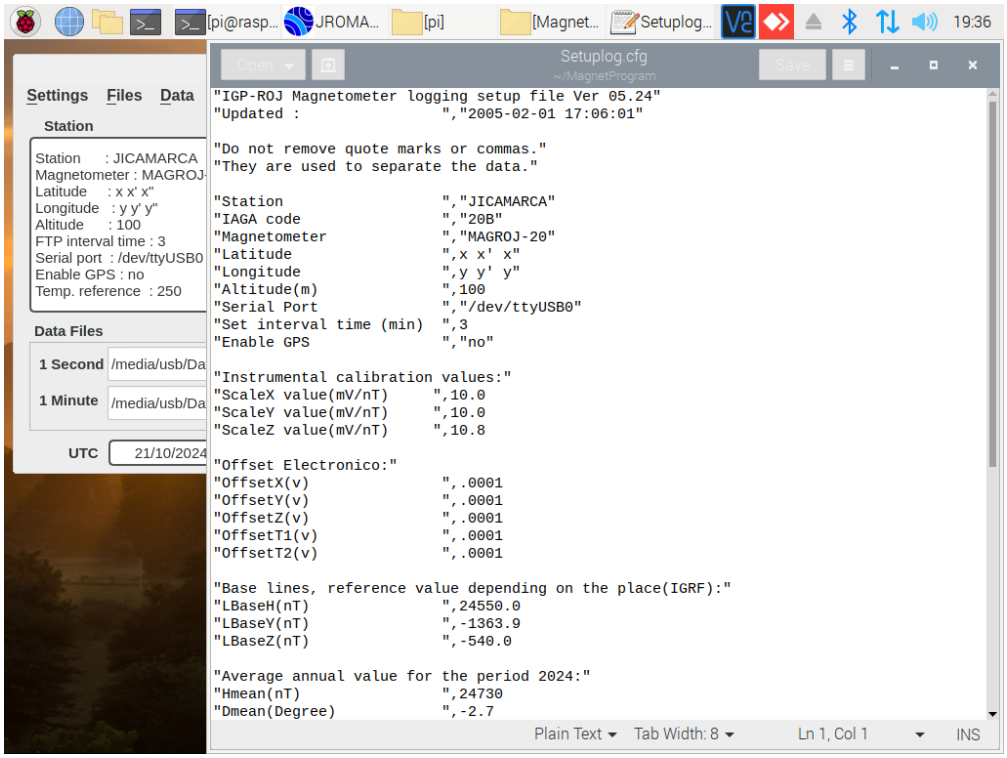

Figure 15. *Access to the Setuplog.cfg file from the acquisition program.*

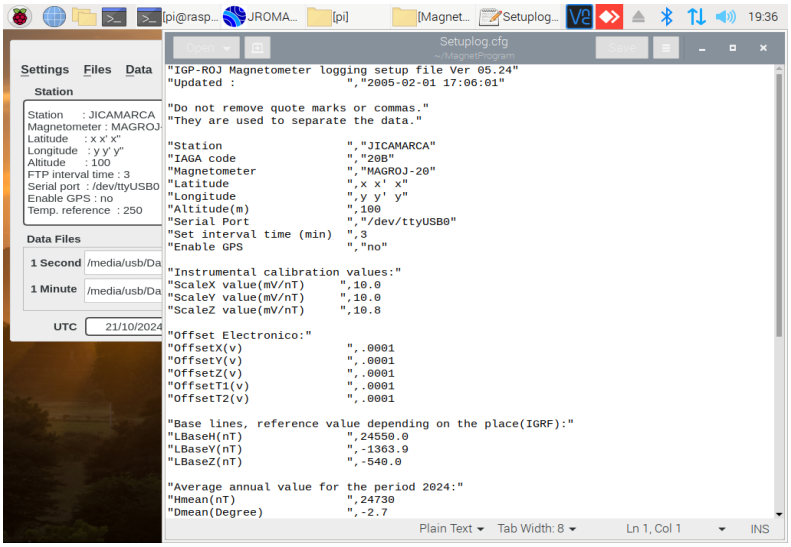

Figure 16. *Access to the Fgxfiles.txt file from the acquisition program.*

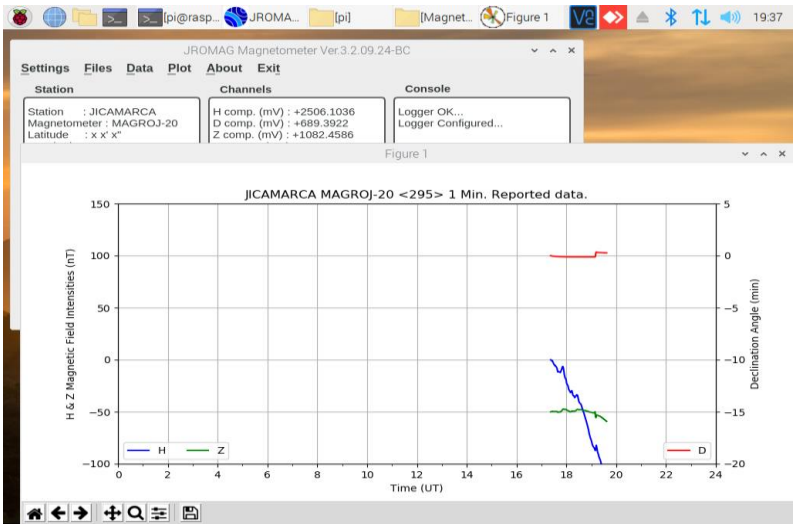

Figure 17. *Minute magnetogram display from the acquisition program.*

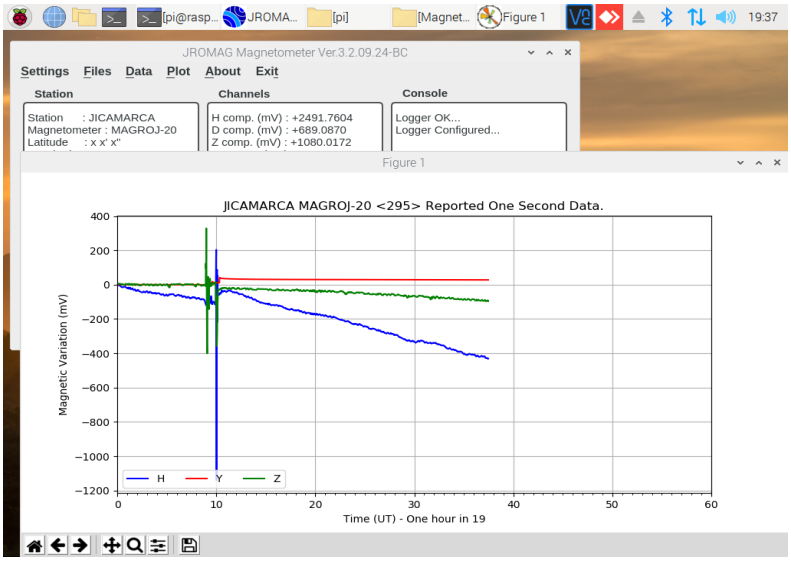

Figure 18. *Magnetogram display of seconds from the acquisition program.*

Note: The values of the AUX1, AUX2 and AUX3 channels are signals external to the magnetometer and are read from the ANALOG OUTPUT connector in Figure 1. This connector has the option to provide buffered analog output of the signals H, Y, Z, Control Temp. and Sensor Temp. components for using with another external data logger, in addition provides also the possibility of acquiring external analog signals from external sensors in the +/-10V range. The most common use is to add other temperature sensors such as the LM35 for monitoring the room or outside temperature related to the magnetometer operation. The connector pinout layout is shown in Figure 19.

Pin	Signal	Function
1	Comp. X	Analog output
2	Comp. Y	Analog output
3	Comp. Z	Analog output
4	Temp. Control	Analog output
9	Ground	Referenced to signals
14	AUX. 2	Analog input (*)
15	AUX. 1	Analog input (*)
16	AUX. 0	Analog input (*)
17	Temp. Sensor	Analog output
23	+12V	Power supply output
24	Ground	Power GND supply
25	-12V	Power supply output

Table 1. *Analog input/output in ANALOG OUTPUT connector.*

* Optional inputs available for the user to connect another signal such as external temperature sensors.

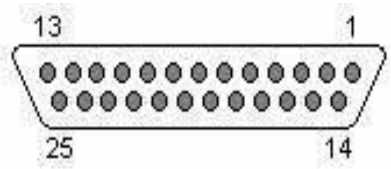

Figure 19. *Pinout DB25 analog Input/Output connector distribution.*